Carving human nature at its joints

A-TRiC, a new theory on human personality

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Master's thesis
Psychology
Medical Faculty
February 2019
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54 pages (incl. 8 pages of appendices)

Abstract

Objectives. A new theory of personality is presented. The A-TRiC is unique in having a substantive theoretical basis in human evolutionary history and the phylogenetic constraints on development of dimensional psychological traits. Trust, Reactivity (to threat) and (need for) Control are personality traits found in all social mammals. Independence affects need for social reward, Analytical Thinking affects willingness to adhere to mechanistic/reductionistic vs intuitive/holistic explanations to phenomena. Since it would be futile academic egotism to propose a new theory unless one is needed, the psychometric and theoretical problems of the mainstream Five-Factor theory are also analysed.

Methods. 1027 participants (61% female; M_{age} 41) completed the A-TRiC questionnaire online. Internal consistencies of the traits and model fit were investigated and predictions about traits and some outcomes were tested.

Results & conclusions. Internal consistency was acceptable. Central model fit indices showed acceptable to poor fit. Levels of Reactivity and Control were associated with lifetime diagnoses of depression and anxiety. Reactivity was associated with addiction. High scores in Analytical thinking were associated with male gender and a degree in natural science. Women scored higher on Control. Some conceptual confusions hindering progress in the scientific study of personality are discussed in light of the theory and its background assumptions.

Sammanfattning

Avsikt. En ny personlighetsteori presenteras. A-TRiC är unik i att den har en substantiv teoretisk bas i människans evolutionshistoria och beaktar de fylogenetiska begränsingar som berör utvecklingen av dimensionella psykologiska egenskaper såsom personlighetsdrag. Tillit, Reaktivitet och Kontrollbehov är de dimensioner vi har gemensamt med alla andra sociala däggdjur. Självständighet påverkar behovet av social belöning, medan Analytiskt Tänkade påverkar viljan att anamma mekanistisk-reduktionistiska eller intuitiva-holistiska förklaringsmodeller. Eftersom det vore akademisk egotism att formulera en teori om det inte fanns behov för en sådan, analyseras även den gällande femfaktorteorins psykometriska och teoretiska problem.

Metoder. 1027 deltagare (61% kvinnor; $M_{ålder}$ 41) gjorde A-TRiC-personlighetstestet på nätet. Testets interna konsistens och modellanpassning utvärderades och vissa förutsagda effekter av personlighetsdragen testades.

Resultat & slutledningar. Dimensionernas interna konsistens var acceptabel. Centrala modellanpassningsindex indikerade acceptabel till svag modellanpassning. Reaktivitets- och Kontrollbehovsnivån var associerade med diagnosticerad depression och ångest. Reaktivitetsnivån var associerad med beroende. Högre nivå av Analytiskt Tänkande var associerad med manligt kön och studier i naturvetenskap. Kontrollbehovet var högre hos kvinnor. Vissa konceptuella oklarheter som hindrar vetenskapliga framsteg inom personlighetspsykologin diskuteras i ljuset av teorin och dess bakgrundsantaganden.

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> "Scientists work from models acquired through education and through subsequent exposure to the literature, often without quite knowing or needing to know what characteristics have given these models the status of community paradigms" (Kuhn, 1962, p. 46)

> "Daher ist die Aufgabe nicht sowohl zu sehen was noch keiner gesehen hat, als bei dem was Jeder sieht, zu denken was noch Keiner gedacht hat." (Schopenhauer, 1851, p. 93)

1. Introduction

Personality is a fascinating subject. Our individual differences have been discussed at campfires, bars, offices and universities ever since there has existed a language with which to do so. The one thing that we do not know, despite millennia of human pondering and a century of professional psychological theorizing, is the true structure of personality. What are the basic, indivisible, independent and immutable traits that give rise to our individual differences?

Many seem content with the situation as it is. There are hundreds of tests purporting to measure aspects of personality, and these are used every day in research departments and businesses around the world. There even exists a kind of consensus claiming we in fact know the structure of personality. A majority of journal editors and authors of textbooks and, as a result, teachers at psychology departments, believe the Five-Factor Model and its sibling the Big Five (henceforth referred to as FFM/B5) accurately and comprehensively describe personality. For decades, psychologists have graduated believing human personality consists of five broad traits, each composed of six sub-traits.

According to the FFM/B5, personality is a hierarchical construct, where five *domains* causally affect how a person is placed on 30 *facets*. The domains are named Neuroticism (Emotional Stability in B5), Extraversion, Openness to Experience (Intellect in B5), Agreeableness and Conscientiousness. In practice, questionnaire items measure the facets, and by summing scores from the six facets belonging to a domain, one's placement on the domain dimension is determined. There are differences in descriptions and names of the domains, but mainly FFM and B5 tests differ in that the former often use items consisting of whole sentences like *I would enjoy spending my holiday at a casino*, whereas B5 tests mostly use lists of adjectives. Both types of tests use Likert scales for scoring.

The full-length NEO-PI-R and its newer, linguistically simplified version NEO-PI-3 consist of 240 items, eight for each facet (Costa & McCrae, 1992; McCrae, Martin & Costa, 2005). According to Hofmans, Kuppens and Allik (2008), the NEO-PI-R is the most comprehensive instrument

available for measuring the FFM/B5 and by 2017 it had been translated to at least 37 languages and used in at least 60 countries or cultures (Allik et al., 2017).

The most popular short version, and the test usually used in research settings is the NEO-FFI (NEO Five Factor Inventory) and its newer versions NEO-FFI-R and NEO-FFI-3. The FFI questionnaires consist of 12 items per domain, chosen from the full-length questionnaires, and they only provide results on the domain level. In fact, the FFI items were not chosen to represent all facets equally, but according to how well they correlated with their domains in the American normative sample for NEO-PI-R (McCrae & Costa, 2004). As a result, the NEO-FFI domain Neuroticism has no items from facet N5 Impulsiveness, Agreeableness has none from A5 Modesty and Conscientiousness none from C1 Competence or C6 Deliberation (Costa & McCrae, 1992).

Despite its popularity and widespread use, the FFM/B5 is fraught with both psychometric and, more worryingly, theoretical problems. In this thesis it is suggested that we still haven't carved human nature at its joints and that the current consensus theory is not a valid model of personality. First, psychometric evidence from existing research will be provided along with theoretical arguments to convince the reader, that there is indeed something askew with the emperor's garb. The psychometric critique will mainly concentrate on results obtained using NEO-PI-R in its different guises, as it is the key operationalisation of FFM/B5. Finally, a new model of personality, based on substantive theory and focused on what kinds of traits could have evolved in our species, is presented.

1.1 Psychometric problems of FFM/B5

When confronted with the model's theoretical shortcomings (see section 1.2) FFM/B5 advocates appeal to its wide acceptance and practical usefulness. Implicitly it is assumed and sometimes explicitly stated (McCrae & Costa, 1997), that the traits are universal and that they predict many important real-life outcomes (e.g. Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007).

The claims about the practical usefulness and universal acceptance of FFM/B5 are certainly true. NEO-PI-R and its shorter versions are arguably the best-selling tests that aim to measure normal personality, and as research using them tends to get accepted for publication, it is useful for academic psychologists also. These facts, however, have no bearing on the validity of the theoretical assumptions behind FFM/B5 nor on the verisimilitude of the alleged personality traits, which are the two scientifically relevant issues.

The claim about **universality** (e.g. Allik, 2002) turns out to be exaggerated. Church, Alvarez, Mai, French & Katigbak (2011) showed that around 40-50% of NEO-PI-R items show differential item functioning in samples from the United States, the Philippines and Mexico, and average inter-item

correlations within facets ranged from .04 to .23 in the Mexican sample. Among forager-farmers in Bolivia, the five factors didn't emerge at all (Gurven, von Rueden, Massenkoff, Kaplan & Vie, 2013). Average within-domain correlations ranged from .05 for Neuroticism to .19 for Conscientiousness, while cross-correlations among domains ranged from .29 to .60 (Gurven et al., 2013). There was no difference among Spanish-speakers and those speaking the indigenous language, nor between the educated and non-educated (Gurven et al., 2013). In other studies, the NEO-PI-R domains Agreeableness and Extraversion have proved to be most inconsistent cross-culturally (reviewed in Rolland, 2002).

1.1.1 Predictive powers

Claims have been made that the FFM/B5 predicts diverse outcomes ranging from job performance (Barrick & Mount, 1991) to eating disorders (De Bolle et al., 2011). Looking closer at the correlations between test and outcome, it becomes less a case of trait predicting outcome and more a case of single items and outcome measures being identical or defined by the same criteria. For example, De Bolle et al. (2011) found that Neuroticism, and specifically its facet Impulsiveness predicted binge-eating and differentiated between anorexic and bulimic patients. This is not surprising, as six out of eight items from the Impulsiveness facet deal with inability to control cravings, and two of those are specifically about eating too much at a time (Costa & McCrae, 1992). Item-level analyses of the NEO-PI-R are seldom performed, but they can be informative. A study by Terraciano, Costa and McCrae (2009) shows, that there is an association between Neuroticism and being overweight, but only due to correlations between body-mass index and the two Impulsiveness items concerned with eating too much.

Associations between Extraversion or Neuroticism and life satisfaction and feelings of well-being also may be seen as somewhat trivial, since they are only due to facets E6 Positive Emotions and N3 Depression (Schimmack, Oishi, Furr & Funder, 2004). Even for more obvious associations, like between job performance and Conscientiousness, the predictive power can be quite small. In a meta-analysis by Barrick and Mount (1991), Conscientiousness was deemed a valid predictor of job performance with an average correlation of .13 between Conscientiousness scores and three indicators of performance in 117 studies.

To sum it up, the predictive power is often due to single items that describe the outcomes themselves. In line with this are results that show the superiority of facets over domains as predictors of behavioural outcomes (Paunonen & Ashton, 2001). As long as the correlation between domain and outcome is lower than the correlation between items (or facets) and outcome, the parsimonious explanation is that the domain-outcome correlation is largely an artefact. This applies to reflective models like FFM/B5, where domains are seen as causes of variations in lower level

variables, which, by definition, are supposedly imperfect indicators of domain function (Mõttus, 2016).

1.1.2 Internal consistency

Facet-level Cronbach's alphas of NEO PI-R were on average .71 (range .50 to .82) in a sample of 12,156 (McCrae, Kurtz, Yamagata & Terraciano, 2011). This translates to an average within-facet correlation of .24 (range .13 to .35). In the newest version, NEO-PI-3, McCrae, Costa and Martin (2005) altered 37 items to improve readability, but this led to no improvement in average Cronbach's alpha in their study sample (McCrae & Costa, 2010). In a Greek sample, average facet-level alpha for NEO-PI-3 was .59 with a range from .30 to .73 (Fountoulakis et al., 2014). This translates to an average inter-item correlation of .15 within the facets.

Mullins-Sweatt, Jamerson, Samuel, Olson and Widiger (2006) looked at how facet scores correlated in FFMRF, an abbreviated version of NEO-PI-R, where each facet is measured by a list of adjectives instead of eight items. In their sample, Warmth (E1) had higher cross-correlations with four Agreeableness facets (.22-.41) than its average correlation (.20) with other facets of Extraversion. Impulsiveness (N5) had an average correlation of .19 with other Neuroticism facets, whereas its cross-correlation with Self-discipline (C5) was -.27 and with Order (C2) -.22. The same discrepancy applied to correlations between Self-Consciousness (N4) and Gregariousness (E2), and between Depression (N3) and Action (E4), and between Depression (N3) and Positive Emotions (E6).

These results are informative, as the FFMRF unmasks truer associations between facets because it doesn't have redundant items like NEO-PI-R, where near-identical items "weigh down" the facets. Two items that do not differ in their semantic content will, through summing, account for four times the variance compared to a single item. Such items **artificially inflate internal consistency at the facet-level** (Clark & Watson, 1995).

For example, there are five items in facet C6 Deliberation, which are about making hasty decisions and three in C5 Self-discipline about getting things done[*]. Two items from E1 Warmth refer to getting pleasure from talking with people and two from E2 Gregariousness refer to enjoying being among lots of people. Pairs of semantically near-identical items can also be found in N6 Vulnerability, N5 Impulsiveness, as well as three items about easily losing one's temper in N2 Angry Hostility.

Likewise, near-identical items form "bridges" between facets belonging to the same domain, thereby **artificially inflating internal consistency at the domain level**. One example is a pair of items

[*] Items from the commercial NEO tests may not be reproduced verbatim for proprietary reasons.

about having control over one's emotions from N5 Impulsiveness and N6 Vulnerability, respectively. Another bridge is formed by two items about feeling inferior from N3 Depression and N4 Self-Consciousness. There are further bridges between C1 Competence and C2 Order (about being organized) and between A4 Cooperation and A6 Empathy, too (about being hard-headed).

Correlations between the supposedly independent **domains** are substantial, except for Openness, which does seem independent from all but Extraversion. For the remaining four domains, van der Linden, te Nijenhuis and Bakker (2010) found average cross-correlations ranging in absolute value from .38 to .51 for NEO-FFI and from .22 to .68 for NEO-PI-R in a meta-analysis of studies with a total of 144,117 subjects.

In two large samples from Switzerland and Spain, average inter-item correlation within domains was .20 for the NEO-FFI-R (Aluja, Garcia, Rossier & Garcia, 2005). This average within-domain correlation was lower than the average across-domain correlation in another study using NEO-FFI-R (McCrae & Costa, 2004).

1.1.3 Why so inconsistent?

A reason for the inconsistent structure of FFM/B5 tests might be a wish to have tests where scores correlate with diverse real-life outcomes. If the FFM/B5 tests do not measure true personality traits, then the only way to achieve this goal is to include items that directly describe the outcomes, and just accept the poor psychometrics. Indeed, the NEO-PI-R does contain items very similar to items on diagnostic tests like Beck's Depression Inventory and Eating Disorder Examination-Questionnaire and items that are trivially predictive of outcomes in the educational and industrial-organizational settings, like those that make up the Conscientiousness facets Achievement-Striving, Self-Discipline, Competence and Dutifulness.

This hypothetical explanation is corroborated by how McCrae, one of the authors of the NEO tests, justifies the inclusion of items with poor correlations in the same facet (italics added):

> "[One of the] Angry Hostility items concerns feelings of bitterness and resentment; another concerns being hot-blooded and quick-tempered. *These are clearly related affective dispositions* (they are characteristic negative emotions prompted by and focused on the perceived hostile actions of others)." (McCrae, 2015, p. 6).

It is also theoretically conceivable, that bitterness (an internalizing, situational emotion) and a quick temper (externalizing and constitutional) would not have much to do with each other apart from being subjectively negative emotional states. So why include these measures into one facet when they do not correlate? To McCrae, the answer is practical usefulness:

> "An Angry Hostility scale consisting solely of bitterness items would in fact be a Bitterness scale and a relatively poor predictor of, say, spouse ratings of temper tantrums." (McCrae, 2015, p. 7).

McCrae believes that aiming for internal consistency only leads to a "selection of items that essentially ask the same question again and again" (McCrae, 2015, p. 7), but the more parsimonious explanation for the lack of internal consistency is that neither domains nor facets are true, coherent traits and, therefore, items that measure them will not correlate, unless made essentially identical.

McCrae (2015) further justifies the heterogenous structure of domains and their low internal consistencies with their usefulness as predictors. He mentions that having a facet for Positive Emotions, E6, makes Extraversion a better predictor of emotional well-being than one without it. This is true. The scientifically relevant issue, however, is the test-independent existence of a trait that causes a predisposition to both exuberant expressions of joy (E6 Positive Emotions) and a wish to be a leader of others (E3 Assertiveness).

Due to the large cross-correlations and low internal correlations, the FFM/B5 test results will also lend themselves to several other psychometric interpretations: There will be two super-traits above the domains (Digman, 1997), or just one General Personality Factor (Rushton, Bons, & Hur, 2008); there will be intermediate traits between facets and domains (DeYoung, Quilty, & Peterson, 2007; Judge, Rodell, Klinger, Simon & Crawford, 2013) and between facets and items (McCrae, 2015). The structure also easily splits into more than five domains, as in the HEXACO model (Ashton & Lee, 2007).

And as Cattell noted, it makes no difference how trait words are lumped together; in the end they will all end up flowing into each other in a "continuous, straggling network" (1943, p. 498). Such continuity can be conceptualized as a circular structure, like the AB5C (Hofstee, de Raad, Goldberg, 1992).

1.2 Theoretical problems of the FFM/B5

The lexical hypothesis is often given as the theoretical basis of the FFM/B5. A closer look at historical events (Appendix 1) makes it evident that the lexical hypothesis was not instrumental in formulating the FFM/B5. The five traits were uncovered using subjectively chosen parts of Raymond Cattell's trait catalogue, which in turn was formed from a subjectively pruned list, consisting of less than 10% of the original 4504 trait words chosen from the lexicon, and into which new words were added during the process. But a more relevant question is: Had we arrived at a valid description of human personality structure, had the pioneers followed the lexical hypothesis religiously? I believe not.

The lexical hypothesis states, that words for important individual differences will be encoded in natural language. All that is needed is to find out how these words cluster together when people

describe each other and themselves, and at the semantic centres of such clusters will be the essences of the traits that make up personality.

This is where the lexical hypothesis goes astray. Language is not a repository of information describing the structure of reality, but a tool for, in equal measures, social communication and manipulation (e.g. Oesch, 2016). During most of human history – before the advent of job interviews and psychotherapy – people had very little reason to describe themselves to strangers. Words accumulating in language would therefore be those we use to describe third parties and, specifically, their dependability or deviousness, their kindness or cruelty, their boldness or cowardice, their skills and abilities – in short, their potential worth in cooperative endeavours and as mates. The words will therefore be evaluative and those describing negative behaviours will be more abundant, since potentially harmful behaviour is more important to be aware of than harmless behaviour (Pratto & John, 1991). When Louis Thurstone performed some of the first factor analyses of trait words ever, he indeed observed that "the largest constellation of traits consists of derogatory adjectives" (Thurstone, 1934, p. 16).

So, what does the FFM/B5 measure, if not personality? Even given their somewhat amorphous consistency, the traits do reflect *something* in people. As described above, the words which filtered into the five proto-factors, were evaluative and overwhelmingly negative. Much work was done to rid the subsequent tests of words that were too judgmental, but still the factors have a clear good-bad -dimensionality: It is better to be agreeable and gentle than disagreeable and headstrong. It is better to be responsible and persevering than undependable and fickle. Poised and calm is better than tense and anxious, and a sociable, active and assertive person is better than a passive recluse.

It is conceivable, therefore, that the FFM/B5 measures a near-universal way in which people tend to evaluate other people (and by extension, describe themselves). Neuroticism might be an exception and instead reflect the subjective choices of adjectives made by clinically minded psychologists during the evolution of the FFM/B5 (see Appendix 1). The factors will likely capture slivers of single personality traits and parts of combinations of traits, but the focus is on what is useful to know about others, and there is no reason such evaluative dimensions should coincide with the basic, independent personality traits.

As McArthur and Baron (1983) concluded, our perception is adaptive; we perceive and encode into language those aspects of reality which are useful for our survival and reproduction. There is no more reason to believe that natural language contains the keys to delineating personality traits, than there is to believe that language is the key to understanding electromagnetic radiation. Still, the lexical hypothesis has been almost universally accepted as a basis for personality theory. Even among those who readily admit that the FFM/B5 structure is flawed, most suggest that personality traits should be looked for in language (e.g. Boyle, 2008).

Scientists in other disciplines have been able to see beyond the surface of phenomena, beyond that which is merely expressed in natural language, and there is no reason why psychologists should not strive to do the same. Therefore, I suggest that the lexicon is not the place to look for personality. The place to start should be our evolutionary history and universal mammalian personality traits.

1.3 The A-TRiC

When constructing a scientific theory, it is important to define one's terms unambiguously and to make explicit the underlying assumptions the theory takes for granted. These requirements are sometimes overlooked in the study of personality and other softer disciplines within psychology. We are inclined to "move the goalposts" to accommodate new data instead of formulating theories in a scientifically rigorous manner and discarding them when they are refuted or when a better theory comes along (e.g. Meehl, 1978; 1986). To avoid this mistake, a modified definition of personality and the underlying assumptions of the A-TRiC model will be given below.

1.3.1 The definition of personality

One of the challenges in determining the structure of personality is keeping apart that, which is innate and unchanging and that, which is plastic and situational. In most current definitions, personality includes behaviour, as in Pervin and John's "a person's consistent patterns of feeling, thinking, and behaving" (1997, p. 4) or Funder's "an individual's characteristic patterns of thought, emotion, and behaviour" (2004, p. 5). This makes for so broad a construct, that it has led some to lose heart and conclude that there is no personality (Lamiel, 1981), or at least that situational factors trump any constitutional traits and that, in the end, all human behaviour is dependent on environment only (Wright & Mischel, 1987). I concur with Hofstee, de Raad and Goldberg in that "all of humankind does not provide sufficient degrees of freedom to determine the *behavioral* effects [of personality]" (1992, p. 162, italics added). I sympathize with these researchers' frustration and believe it is indeed futile to look for personality in behaviour. Not because there is no personality or because it has no effect on behaviour, but because behaviour is only a distant echo of it – a complicated function of situation, culture, life history, social learning *and* personality. The one thing we cannot choose according to social setting and culture, however, is our emotional response. According to A-TRiC, therefore, the valence and strength of emotional responses are the true essence of personality. Or, more correctly, the closest thing we can come to the true essence, which is individual neuroanatomy and synaptic dynamics.

For the purposes of my theory, personality is therefore defined as *innate*, inter-individually varied intra-individually stable *emotional* responses to *certain types of situations*. Being innate does not mean that the trait is manifest from birth, only that its development is genetically hardwired and that it is

immune to environmental influences once its neurophysiological development is finished. So, innateness does not preclude the possibility that the neural architecture responsible for the trait is susceptible to environmental influences during so-called sensitive periods, when network architecture goes through genetically programmed changes (Knudsen, 2004). That the emotional reaction is hardwired, does not mean that it leads to identical behaviour in all instances. Excluding extreme situations, behaviour and expression of emotions are very much influenced by learning and cultural expectations (e.g. Ekman, 1972), which is why attempting to map typical behaviour is a blunt instrument when measuring personality traits.

Importantly, a personality trait is a continuum along which individuals consistently differ from each other as to the valence and strength of their emotional response to *certain stimuli*. For each trait, therefore, there exists a specific *stimulus space*. The stimulus space refers to the sum total of types of situations where a trait becomes activated. To delineate this stimulus space is as important as determining the emotions involved in the expression of each trait, and it is also the hardest part of the endeavour.

1.3.2 The underlying assumptions of the A-TRiC

To assess the prior probability of a theory, it is essential to know all its underlying assumptions. These are propositions which connect the theory to its nomological net; they are assumed to be true and not put to the test. In the words of Daniel Kahneman: "The errors of a theory are rarely to be found in what it asserts explicitly; they hide in what it ignores or tacitly assumes." (Kahneman, 2012, p. 274).

The FFM/B5 has one underlying assumption: that natural language contains words that reveal the structure of personality when they are combined into clusters of synonyms according to how people use them when describing themselves or others. The A-TRiC is based on three assumptions, outlined below. These are considered beyond reasonable doubt in their respective disciplines, but they need to be stated explicitly, as some theories within psychology implicitly assume they are either irrelevant to the study of the human mind, or not even true.

The first assumption is that all conscious experience like grieving, rejoicing, hating, fearing, thinking, remembering, problem-solving, sensing, planning, suffering, loving, hurting, perceiving and yearning, is brain activity. From this follows, that identical activity within a certain combination of neural networks is always equal to the same conscious experience, as there is no other way to account for different "contents/states of mind" than as activities in different populations of neurons. Therefore, differences in the architecture of neural networks and the way information flows through them, is what makes one individual mind different from another. This naturally doesn't apply to personality only, but also to how the brain solves problems, how it holds

information active in working memory, how it produces behaviour and retains information in long-term memory and how it activates those memories, and so on.

The second assumption is that the activity of proteins in brain cells is governed by the same causal laws as the activities of proteins in other cells of the body; that there exists no immaterial entity able to causally affect their activity, i.e., there is no soul, no free will, no one "using the brain". (This assumption should not be confused with the fact that all neurologically normal humans have an absolutely certain *experience* of having free will.) Some hypothesise there exists a "systemic level" that causes the brain to act in non-determined ways (Mannino & Bressler 2015). No one has yet clarified what a systemic level is, or how it could affect the workings of neurons and the networks they form, in ways not following from the normal causalities between input and output in neurons, so for now, it is assumed that the systemic level is a euphemism for free will.

Every heartbeat, every tender whisper and angry frown, every action potential, every synaptic event, every thought and feeling, as well as the synthesis of neurotransmitters, the guidance of neurites and formation and pruning of synapses, is protein activity. For proteins, activity is structure. What a protein does, is a direct effect of the electric, hydrophobic and spatial interactions between the amino acids it is made of. And the information of the sequence of amino acids in all proteins is contained in the genes. An organism therefore can only do what its proteins do; its proteins can only do that, which their structure commands. And their structure can be nothing else than that, which is in the genes.

Even if a trait were finalized *in utero* by maternal hormones acting to cause epigenetic modifications in the foetus, those modifications would be made by proteins, whose structure and hence function is determined by the genes of the foetus. There is therefore nothing non-genetic about epigenetics, and nothing non-genetic about any other environmental effects on function. But even though it is "all" in the genes, it's important to understand, that genes themselves do not *do* anything. They are only an inert repository of information on how to build the molecules that do everything, i.e. the proteins.

Finally, **the third assumption** is, that during evolution, nothing new can evolve that isn't compatible with that which already exists. This really is a truism, but it is exceedingly important in the case of the most phylogenetically constrained organ of all, the brain. The only raw material natural selection has to work with, is random mutations. A mutation can only be tolerated and spread in the population, if its phenotype works flawlessly with all the existent functions it affects in the organism. As degrees of freedom are curtailed by stringent compatibility requirements, it follows, that evolutionary change in complex structures takes a long time – and there exists no more complex thing in the known universe than the brain of social mammals.

The human brain is therefore a primate brain with added networks for dexterity, conceptual thinking and language, and the primate brain is a mammal brain with adaptations for diurnal, arboreal and social living. One of the things we have in common with our mammalian relatives, is our emotional machinery. The increased area of the human neocortex has made it possible to activate different emotional programs in human-specific circumstances, and as conceptual thinkers, we can ascribe these emotions to near limitless reasons, but the emotions themselves are the same (e.g. Panksepp & Biven, 2012). What makes us unique among mammals are our cognitive and communicative capabilities and our manual dexterity, not our emotional inner life.

In short, the assumptions of A-TRiC are 1. Emotions are brain activity, 2. Neurons are subject to the same laws of causality as all cells, and 3. Man is a social mammal whose brain, personality included, evolved to its species-specific modern form during the last 50-200 000 years in Sub-Saharan East Africa – an environment very different both socially and technologically from the one we inhabit now.

There is yet another, often overlooked issue to consider when theorizing about dimensional traits, like those that make up personality. If there exists genetic diversity in a trait, and any point on the continuum of its phenotype is consistently even slightly better in terms of reproductive success (fitness) of its bearer, the trait will be driven to fixation and phenotypic diversity will disappear. The trait will become a species-specific universal that will display almost no genetic variability in normal individuals. Any personality trait, therefore, must have been be adaptively neutral along its normal continuum in the environment where humans evolved, and the opposite poles must have had trade-offs of equal magnitude; any benefit of being high or low on a trait, must come with a cost. This is a test that the traits of A-TRiC will have to pass in future studies if it is to be considered a valid model of the structure of human personality.

There has been very little research on fitness and the FFM/B5, but results show a consistent correlation between reproductive success and traits Extraversion, Neuroticism and Openness (Alvergne, Jokela & Lummaa, 2010; Berg, Lummaa, Lahdenperä, Rotkirch & Jokela, 2014; Jokela, Alvergne, Pollet & Lummaa, 2011). This implies that those traits cannot be true personality traits.

1.3.3 The traits of the A-TRiC

As the above assumptions make clear, the very basis of any scientific theory of personality must build on what is evolvable in humans. Due to the phylogenetic constraints on the brain, we can safely assume that if universal mammalian personality traits exist, then because of common descent, we have them, too. During the expansion of the neocortex in humans, species-specific modifications and expansions of the stimulus space that activates each trait have certainly taken place, but the basic traits themselves must have been preserved.

It turns out all mammals (indeed, all vertebrates) studied so far exhibit intra-individually stable, inter-individual differences in responses to novelty (Budaev, 1998). Social mammals also exhibit inter-individual variability in how they react to conspecifics, and in how they react to social threat (Gosling, 2001). In a review of all studies on non-human primate personality, the clearest traits to emerge were indeed sociability, response to novelty and response to threat (Freeman & Gosling, 2010).

Given the underlying assumptions behind A-TRiC, these three universal mammalian traits must be part of human personality as well. In addition, the A-TRiC includes two traits, arrived at by the age-old methods of scientific discovery: observation, study and armchair theorizing. Below, each hypothetical trait is given a brief presentation along with comments on how it compares to some related traits described by earlier researchers.

In A-TRiC, the human equivalent of response to novelty is named (need for) **Control**. High need for Control manifests itself as timidity or wariness in new and strange situations and a dislike for sudden and unexpected changes in circumstances. At the opposite extreme are those, who are open to uncertainty and do not worry about the consequences of their actions. This does not mean that low Control is sufficient to make someone an impulsive excitement-seeker, but it is a necessary condition. Due to the different evolutionary roles for men and women in protecting offspring from harm on the one hand, and winning respect among peers by being ready for risky endeavours on the other, it is likely that women, on average, have higher levels of Control than men (e.g. Buss, 1989; Geary & Flinn, 2001).

People with high levels of Control experience an undercurrent of emotional strain and anxiety in their daily lives, which makes them more susceptible to long-term stress and its consequences. Anxiety is a normal reaction to an aversive situation that is not strong enough to elicit outright fear and avoidance (e.g. McNaughton & Corr, 2004). It causes a subjectively uncomfortable state of "being torn in two" by opposing motives: to escape from the aversive situation or approach it and actively deal with it. This state allows the brain to gather information and make its appraisal on a complex, risky issue with pros and cons associated with all potential behavioural responses.

Having a higher likelihood of finding unfamiliar or uncontrollable situations aversive, as by definition those with high levels of Control do, will make a person more susceptible to experiencing anxiety and developing stress. Therefore, Control should be associated with a propensity to suffer from clinically relevant anxiety/depression.

Among existing psychometric tools, Burger and Cooper's Desirability of Control Scale (1979) is for the most part a good measure of A-TRiC Control, but it contains some items that measure something akin to learned helplessness and assertiveness, which are not a part of A-TRiC Control.

Elements of A-TRiC Control can also be found in the TCI-R facets Anticipatory Worry (HA1) and Fear of Uncertainty (HA2) from trait Harm Avoidance, and Exploratory Excitability (NS1) from trait Novelty-Seeking (Cloninger, 1994). Several questionnaires for sensation-seeking also contain items that measure Control, although they mainly seem to focus on behaviour resulting from proneness to boredom or need for stimulation (e.g. Arnett, 1994; Zuckerman & Cloninger, 1996).

In A-TRiC the emotion that crucially determines sociability in humans is **Trust** – here defined as a warm feeling of goodwill toward other people which includes the implicit assumption that this feeling is reciprocated. The opposite pole of Trust is, logically, suspicion and mistrust – a constant feeling that others are out to get you, unless you get them first. Someone with high Trust enjoys the company of others and is spontaneously generous and cooperative, without expecting something in return. Low Trust means you keep your cards close to your chest and refrain from helping others at your cost unless a profitable payback is certain. You also assume other people are unreliable and only looking out for number one.

Facet A1 Trust from NEO-PI-R is mostly a good measure of A-TRiC Trust, as are some items from facet E1 Warmth. Yamagishi and Yamagishi's General Trust Scale (1988) also measures A-TRiC Trust very closely. The Propensity to Trust Survey items are too focused on moral attitudes and self-image to be of use (Evans & Revelle, 2008), while Rotter's Interpersonal Trust Scale (1967) has been shown to measure at least four constructs, named Political Cynicism, Interpersonal Exploitation, Societal Hypocrisy, and Reliable Role-performance by Chun and Campbell (1974).

Reactivity to threat is named, simply, **Reactivity**. The relevant stimuli to activate Reactivity are situations where there is a risk of losing resources and, especially, social standing. It is about "social territoriality" – protecting one's perceived rights. More specifically, the threat is any perceived intentional act aimed at, or likely to infringe on, freedom, status or intended goals. As social standing is experienced as important, the proactive aspect of Reactivity is dominant aggression/assertiveness. High Reactivity makes a person explosive and on high alert all the time. It brings with it an undercurrent of baseline negative feelings and constant tension. Impatience and proneness to boredom are therefore integral parts of Reactivity and a highly reactive person is likely to look for any stimulation (sex, drugs, sport, excitement of any sort) to alleviate the tension. Highly reactive people are hypothesized to have constantly elevated stress-levels, which is one prerequisite of clinical depression, acting by way of low-grade, long-term systemic inflammation (Pasco et al., 2010; Rohleder, 2014). Someone low in Reactivity is calm, submissive and easy-going in the face of frustrations and it is hard to provoke him* into aggression. (Since people intuitively ascribe intentions to inanimate but "acting" objects like computers and photocopiers (Waytz, Gray, Epley &

* When singular third person pronouns are necessary, the masculine form will be used throughout. This decision was arrived at through a coin toss (coin: 2 euros; heads-female, tails-male).

Wegener, 2010), someone high in Reactivity would also be likely to rage against machines that fail to do his bidding.)

As Reactivity includes a propensity for aggression and violence, traits akin to it have been extensively studied and operationalised due to their societal importance (e.g. Orpinas & Frankowski, 2001). Reactivity is also measured by seven of eight items from the NEO-PI-R Neuroticism facet N2 Angry Hostility, as well as scattered items from several Agreeableness facets. The same applies to items from the MPQ Scales Aggression and Stress Reaction (Tellegen, Lykken, Bouchard Jr., Wilcox, Segal, & Rich, 1988) as well as the whole six-item CAT-PD-SF scale Anger (Grego, Oltmans & Widiger, 2018).

Independence is a putative trait spanning a continuum from low to high need for social reward. Persons with high Independence don't let their actions be affected by how much praise, respect, glory or acceptance, or lack thereof, is in it for them. Others see them as detached and aloof and maybe a bit odd. Psychiatry has even deemed being "apathetic to the admiration or disapproval of others" a symptom of a mental disorder (APA, 2013). Persons at the low extreme of the Independence spectrum act in ways determined by the expected reactions of other people, seeking their approval or respect, wanting to be liked and admired. This trait has, despite its name, nothing to do with the personality disorder category named Dependence.

To my knowledge, Independence has not been operationalised so far. Intuitively, measures of reward dependence (Cloninger, 1994; Kose, 2003) or reward responsiveness (van den Berg, Franken, & Muris, 2010) would sound like good candidates, but they do not fit the bill. For example, the Reward Dependence scale of TCI-R purportedly measures the dimension [*critical*, *aloof*, *detached*, *independent*] to [*sentimental*, *open*, *warm*, *sympathetic*]. At the low end it seems to be an adequate measure of A-TRiC Independence (except for the *critical*), but the high end has nothing to do with Independence and a lot to do with A-TRiC Trust. One of the four facets (RD4 Dependence) comes close, but it, too, measures a combination of Trust and Independence (Kose, 2003). The TCI-R Reward Dependence also falls apart into several factors in exploratory factor analysis, so the construct isn't unidimensional (Farmer & Goldberg, 2008). The Reward Responsiveness scale mainly measures willingness to partake in activities that give pleasure (van den Berg et al., 2010).

The fifth trait, **Analytical Thinking**, is the most tentative one. To mark its as yet uncertain place, it is separated from Trust, Reactivity, Independence and Control by a hyphen in the abbreviation A-TRiC. In psychology, the propensity to look for explanations within the realm of either the (analytical) mechanistic-reductionistic or the (intuitive) narrative-holistic, is seen as a cognitive style, not a personality trait. Most theories and their operationalisations focus on individual ability to override the intuitive, heuristic and bias-ridden thinking of the so-called System 1, with the slow, subjectively effortful thinking characteristic of System 2 (e.g. Kahneman, 2003; Tversky &

Kahneman, 1974). This dichotomy between thinking styles has been recognized at least since the days of William James (1890, p. 451).

Abilities are not relevant to personality as it is defined here, but since people seem to differ in a purely emotional willingness to adhere to mechanistic-reductionistic or narrative-holistic explanations, I feel Analytical Thinking fulfils the conditions of a personality trait. At the very least, the trait is an interesting one, since hypothetically it will determine to a large extent who among us are likely to seek answers in the spiritual-religious sphere and who will gravitate toward a scientific-mechanistic worldview. It should also affect educational choices, so that high Analytical Thinking makes people more likely to pursue a career in natural science than other branches of academia. It is likely that men will score higher on this trait than women – a conjecture based on results attained by using scales that measure some aspects of A-TRiC Analytical Thinking (e.g. Baron-Cohen, 2010; Epstein, Pacini, Denes Raj, & Heier, 1996).

High Analytical Thinking is characterized by a willingness to find mechanistic and reductionistic causal explanations to phenomena and a dissatisfaction with other types of explanations, specifically those, which include intentions of supernatural beings or forces. At the other extreme, people show a satisfaction with intuitive, holistic, narrative explanations. They may wish to embrace the mystical and even show a readiness to ascribe phenomena to intentional, supernatural beings, forces or energies.

One model, where not just ability, but also willingness to engage in intuitive and rational thinking is considered, is the Cognitive-Experiential Self-Theory, operationalised by the Rational-Experiential Inventory (REI; Epstein et al., 1996). Some of the ten Experiential (Faith in Intuition) items from the REI engagement-subscale (as opposed to ability-subscale) could be used to measure A-TRiC Analytical Thinking, but the Rationality items, also called Need for Cognition items, measure mainly a wish to think a lot and solve difficult problems as well as a self-reported ability for logical and rational thinking. This is not a construct related to A-TRiC Analytical Thinking, which is a measure of emotional reactions to different types of explanations to phenomena.

Stanovich sees reflection and openness to different viewpoints as central to individual variation in willingness to engage in System 2 thinking, so neither of the operationalisations he and his colleagues have developed, the Argument Evaluation Test (Stanovich & West, 1997) nor the Actively Open-Minded Thinking scale (Sá, West, & Stanovich, 1999), measure A-TRiC Analytical Thinking.

The same applies to the promisingly named Analytic-Holistic Scale (Choi, Koo & Choi, 2007), which contains no items measuring emotional reactions to mechanistic-reductionistic and narrative-

holistic explanations to phenomena, but instead measures actual beliefs about how things are in the Universe and how disagreements between people should be handled, for example.

1.4 Aims of the study

Both theoretical and psychometric analyses indicate it is unlikely that the FFM/B5 maps the true independent traits of human personality. The aim above has been to explicate the requirements for such traits that could have evolved in humans and provide an outline for a model that fits those requirements. It has been all about delineating traits and their stimulus spaces in ways that fit the nomological network formed by what we know about evolution of dimensional traits in general and the evolution of the human brain in particular.

The central aim of this study is to explore the psychometric properties of this first version of an operationalisation of the A-TRiC model ever to be presented to a group of subjects and see how it compares to results obtained from other samples using the NEO-PI-R. The following predictions will also be tested:

1. Men will score higher than women on Analytical Thinking.

2. Women will score higher than men on Control.

3. Addicted individuals will score higher on Reactivity than non-addicted individuals.

4. Those with a diagnosis for depression and/or anxiety disorder, will have higher scores on Control and Reactivity.

5. Those with an education in natural sciences will have higher scores on Analytical Thinking than those with vocational education or humanistic/social/behavioural science educations.

2. Methods

2.1 Participants

Participants (N = 1027; men 37.9%, women 61.0%, other 1.1%; M_{age} 40.9 years, age range: 15-78 years) were passively recruited from the social media site Facebook by placing ads with Administrator approval in several groups of everyday nature, like home improvement, (non-psychoactive) mushroom and berry picking, a discussion group for lay people on scientific issues, a group for everyday financial advice etc. The ad contained a short description of the research in Finnish and a link that lead to the questionnaire, also in Finnish. To provide transparency, anyone could contact me at any time through my personal Facebook profile or by email for additional information. All participants had the possibility to acquire their own test results with comments.

Participants who gave an invented password at the end of the questionnaire and sent me the password from an anonymous email account, got their results mailed to this account.

42.0% of participants had a university degree and 42.8% had a vocational degree (including higher vocational education), while 5.6% had attained only primary education and 9.5% only secondary education. 16.7% were students, 53.4% workers and 12.5% executives, while 17.3% identified themselves as freelancers/entrepreneurs. Those who were unemployed were asked to choose their last position before unemployment.

Markku Verkasalo kindly provided me with raw data on 306 subjects, mainly university students from Finland, Germany and Great Britain (men 33.3%, women 66.7%; M_{age} 23.9 years, age range: 18-52 years) who had filled the NEO-PI-R questionnaire. Unless stated otherwise, all results referred to as NEO data are analysed from this data.

2.2 The questionnaire

The online questionnaire (Appendix 2) consisted of 36 preliminary items assessing A-TRiC traits, and items assessing potentially interesting correlates to the hypothesised traits, like self-reported addiction, and medical diagnoses of depression and/or anxiety disorder. In addition to the preliminary A-TRiC items, some alternative items were included, to be exchanged with the original items, if they were to provide a better fit with the model. The number of items was intentionally larger than the ideal number for the final questionnaire, to allow for pruning of less successful items.

All scoring was on a five-point Likert scale, range 0-4. In total, the questionnaire consisted of 86 items in addition to background questions concerning things like education and profession. Figure 1 shows the final items used for measuring A-TRiC, translated from the original Finnish for demonstrational purposes only.

Addiction was assessed by the item *I am addicted to alcohol or some other substance that produces an immediate feeling of well-being*. The answers were dichotomized by treating the three highest values as admitting to addiction and the two lowest as not admitting to addiction.

The item assessing whether the participant had received a diagnosis of depression or anxiety *I have received a diagnosis for anxiety and/or depression* had the instruction to choose alternative *Never* if they had never had a diagnosis, *Seldom* if they had received a diagnosis for anxiety, *Sometimes* if they had received a diagnosis for depression and *Always* if they had received a diagnosis for both. A

A1 Spiritual and philosophical questions are more interesting to me than science and technology.

A2 I enjoy finding logical and "watertight" explanations to phenomena.

A3 I believe more in intuition than in meticulously analysing everything.

A4 I think it is nice that there are mystical phenomena that science can't explain.

A5 I believe there exists a god or some cosmic energy/force, which can influence events on Earth.

T1 I like almost all people.

T2 I have to get to know someone, before I can trust them.

T3 I trust people.

T4 If I have information that is worth money, I keep it to myself.

T5 If someone has betrayed my trust once, I will not trust them anymore.

R1 I get frustrated if I'm in a hurry and someone is slowing me down.

R2 When I'm angry, I tend to do or say things I'll regret later.

R3 I get easily annoyed, if some gadget or machine doesn't work.

R4 I am impatient.

R5 I am stubborn.

R5 I get bored easily.

i1 I'd be pleased if I were famous and admired.

i2 It is important that people appreciate me.

i3 I would like to be at the very top in my own field.

i4 I'm prepared to do a lot to be respected.

i5 I want to be at the centre of attention.

C1 I enjoy peace and predictability.

C2 Whenever I go on a trip, I make careful packing lists.

C3 Routines calm my mind.

C4 I get easily distracted and lose my concentration in noisy surroundings.

C5 When I think about my future, I always carefully consider all that could go wrong.

C6 I get satisfaction from tidy surroundings and knowing where all my things are.

Figure 1. Items included in the final A-TRiC. *Notes*. A=Analytical Thinking, T=Trust, R=Reactivity, i=Independence, C=Control.

dichotomized variable was formed by combining into one category any answers admitting to receiving a diagnosis, and into the second category those denying ever being diagnosed. The rationale behind combining anxiety and depression into one category is that the comorbidity of the two is so high it is questionable, whether they truly form different ontological categories outside the clinical setting (Caspi et al., 2014; Olfson et al., 1997).

3 Results

All analyses were performed using IBM SPSS Statistics software version 25.0 and IBM AMOS version 25.0. Although Likert scales are ordinal, the item and compound variables computed from the items were treated as continuous variables. This is formally wrong, but also common practice. To give this practice some credence, Rossellini and Brown (2011) used both continuous and categorical modelling when analysing their data on the NEO-FFI. They report, that the results were "virtually identical" for factor loadings and other parameters. As Cronbach's alpha is the indicator for internal consistency that is used in peer-reviewed literature for both domain and facet levels of NEO-PI-R data, and it is computed using Pearson's correlations, Pearson's correlation coefficients will be used for the sake of comparability, instead of the more appropriate Spearman's rank correlation.

There was an average .33% of values missing per A-TRiC item. Since AMOS doesn't allow for any missing values, an imputation was needed. Little's MCAR test result for the complete dataset was $\chi 2(1080, N = 1027) = 1091.55$, $p = .397$, while p-values for each trait separately ranged from .366 to

.804. This indicated that values were missing completely at random, and an imputation of missing values could be performed. To this end, the expectation-maximization algorithm was used.

Figure 2 shows distributions of scores for the A-TRiC trait variables. The distribution for Analytical Thinking is more left-skewed than the other distributions (Table 1), but both skewness and kurtosis were well within what is generally deemed acceptable and the distributions can be considered approximately symmetric (Bulmer, 1979). All trait variables had moderately leptokurtic distributions.

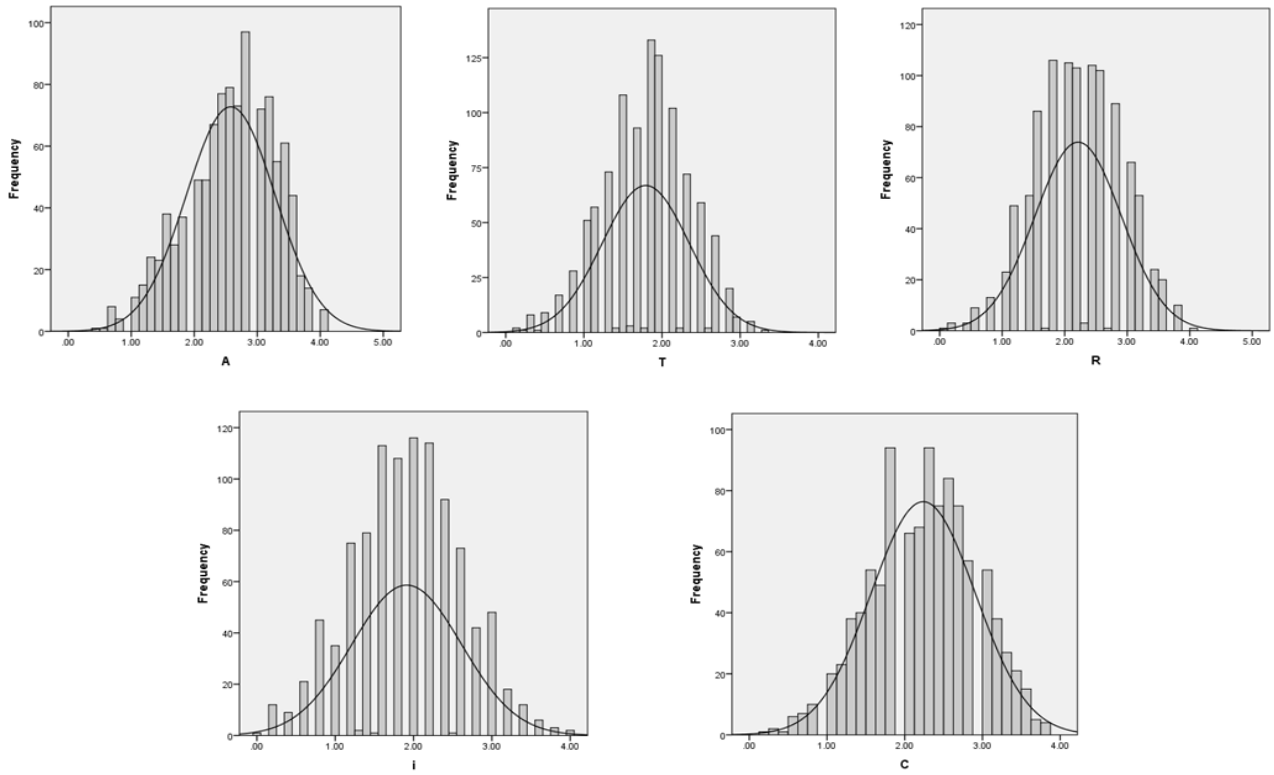

Figure 2. Histograms of A-TRiC trait scores. *Notes.* A=Analytical Thinking, T=Trust, R=Reactivity, i=Independence, C=Control

Correlations between traits were below |.2| (Table 1), except between Reactivity and Independence (-.267) and between Trust and Control (-.249). The highest inter-domain correlations in the NEO data (results not shown) were between Neuroticism and Conscientiousness (-.420), between Extraversion and Openness (.332), between Agreeableness and Openness (.290) and between Neuroticism and Extraversion (-.224).

Table 1

Trait variable properties, inter-trait Pearson correlations, average inter-item Pearson correlations and Cronbach's α

		A	T	R	i	C
N	Valid	1027	1027	1027	1027	1027
	Missing	0	0	0	0	0
Mean		2.53	1.88	2.21	1.91	2.17
Standard deviation		.817	.608	.650	.699	.687
Skewness		-.489	-.167	-.064	-.013	-.090
Standard error of skewness		.076	.076	.076	.076	.076
Kurtosis		-.303	-.339	-.120	-.183	-.356
Standard error of kurtosis		.152	.152	.152	.152	.152
Analytical Thinking		1	-.102	-.022	.052	-.010
Trust			1	-.196	-.063	-.249
Reactivity				1	-.267	.199
Independence					1	-.041
Average inter-item correlations		.544	.381	.502	.486	.423
Cronbach's α		.769	.623	.759	.726	.684

Note. A=Analytical Thinking, T=Trust, R=Reactivity, i=Independence, C=(Need for) Control.

Cronbach's alphas for A-TRiC as well as average inter-item correlations are listed in Table 1. Inter-item correlations are given because they allow for comparisons between variables consisting of different numbers of items, whereas the value of Cronbach's alpha depends on the number of items as well as their correlations, making it less fit as a measure of actual internal consistency (Clark & Watson, 1995).

Average inter-item correlations for A-TRiC ranged from .381 for Trust to .544 for Analytical thinking (Table 1). Average inter-facet correlations for the NEO data ranged from .309 for Openness to .476 for Neuroticism and average inter-item correlations for the facets ranged from .144 for O6 Values to .416 for N3 Depression. Seven facets had average inter-item correlations below .200 and there were negative correlations between items in nine facets.

Average inter-item correlations for the domains measured by NEO-FFI-R items were: Neuroticism .333, Extraversion .242, Openness .215, Agreeableness .197 and Conscientiousness .306. Within the domains there were a total of 36 correlations below .100.

No increase in alpha could have been achieved by removal of any item of the final A-TRiC. In the NEO data, removal of facets N5 (Impulsiveness), E5 (Excitement-seeking), O4 (Actions), A5

(Modesty) and C6 (Deliberation) would have each led to higher internal consistencies for their respective domains for NEO-PI-R.

3.1. Factor structure

The factor structure of the A-TRiC was investigated by performing exploratory factor analysis with fixed number of factors alongside confirmatory factor analysis (Cignac, 2009). Since there was adequate multinormality, maximum likelihood estimation was chosen as it allows for the computation of a wide range of indices of the goodness of fit (Fabrigar, Wegener, MacCallum & Strahan, 1999). The sums of squares of the loadings for the Varimax-rotated solution are in Table 2. The five-factor solution is responsible for the common variance constituting 36.7% of the total variance.

Table 2

Rotation sums of squared loadings for A-TRiC items

Factor	Rotated total	% of variance	Cumulative %
1	2.337	8.657	8.657
2	2.134	7.903	16.560
3	1.952	7.229	23.789
4	1.927	7.138	30.927
5	1.567	5.805	36.731

Note. Rotated total = sums of squared loadings for Varimax-rotated solution.

Results of the exploratory factor analysis of A-TRiC items with factor number set to five, are shown in Table 3 for orthogonal model (Varimax rotation) and in Table 4 for oblique model (Oblimin rotation). The Kaiser-Meyer-Olkin measure of sampling adequacy was .794.

The path diagrams for the A-TRiC and NEO-PI-R orthogonal and oblique models are in Figures 2 and 3, respectively.

Table 3

Exploratory factor analysis of A-TRiC items, five factors, orthogonal rotation

Item	1	2	3	4	5
R3	**.718**	-.032	.204	-.112	-.107
R4	**.712**	-.028	.031	-.157	.032
R1	**.598**	.067	.192	-.160	-.034
R2	**.558**	-.026	.070	-.031	-.087
R5	**.458**	.008	-.021	-.019	-.135
R6	**.426**	-.036	-.151	-.155	-.096
A4	.011	**.736**	-.029	.010	.077
A5	.035	**.682**	-.089	.118	-.085
A3	-.132	**.630**	.087	.021	-.098
A1	-.016	**.609**	-.120	-.002	.005
A2	.038	**.526**	.152	-.100	-.094
C3	.028	-.009	**.682**	.040	-.089
C1	-.034	.046	**.670**	.141	-.140
C2	-.007	.061	**.472**	-.066	-.023
C6	.007	-.056	**.437**	-.134	-.077
C4	.252	-.042	**.412**	.059	-.126
C5	.204	-.028	**.402**	-.102	-.185
i4	-.076	.018	-.133	**.622**	-.020
i2	-.107	.020	-.129	**.618**	-.055
i1	-.151	.034	.106	**.611**	-.022
i5	-.194	.132	.175	**.559**	-.179
i3	-.037	-.095	-.043	**.503**	.076
T3	-.119	-.080	-.017	-.072	**.802**
T2	.016	.014	-.155	-.081	**.544**
T1	-.151	-.164	-.091	-.119	**.464**
T5	-.084	.017	-.131	-.010	**.345**
T4	-.069	-.026	-.057	.154	**.295**

Note. Maximum likelihood extraction, Varimax rotation.

Table 4

Exploratory factor analysis of A-TRiC items, five factors, oblique rotation

Item	1	2	3	4	5
R4	**.730**	-.111	-.005	.000	-.061
R3	**.721**	.013	-.019	.155	-.018
R1	**.602**	-.053	.083	.160	-.081
R2	**.568**	.023	-.016	.031	.042
R5	**.460**	.094	.011	-.065	.036
R6	**.413**	.081	-.030	-.195	-.107
T3	-.023	**-.830**	-.028	.118	-.047
T2	.086	**-.560**	.053	-.072	-.055
T1	-.113	**-.450**	-.137	-.014	-.118
T5	-.039	**-.342**	.038	-.073	-.006
T4	-.009	**-.305**	-.009	-.002	.163
A4	.047	-.128	**.747**	-.013	.005
A5	.063	.048	**.681**	-.099	.110
A3	-.131	.067	**.623**	.084	-.009
A1	.004	-.028	**.614**	-.118	-.015
A2	.028	.048	**.525**	.140	-.108
C3	.014	.008	-.015	**.687**	.050
C1	-.043	.063	.035	**.671**	.143
C2	-.023	-.033	.060	**.480**	-.064
C6	-.030	.038	-.061	**.432**	-.134
C4	.249	.055	-.044	**.392**	.095
C5	.168	.132	-.034	**.370**	-.080
i4	.005	.016	.011	-.119	**.626**
i2	-.033	.057	.010	-.119	**.616**
i1	-.078	-.002	.025	.130	**.607**
i5	-.151	.158	.111	.177	**.540**
i3	.038	-.088	-.095	-.016	**.517**

Note. Maximum likelihood extraction, Oblimin rotation.

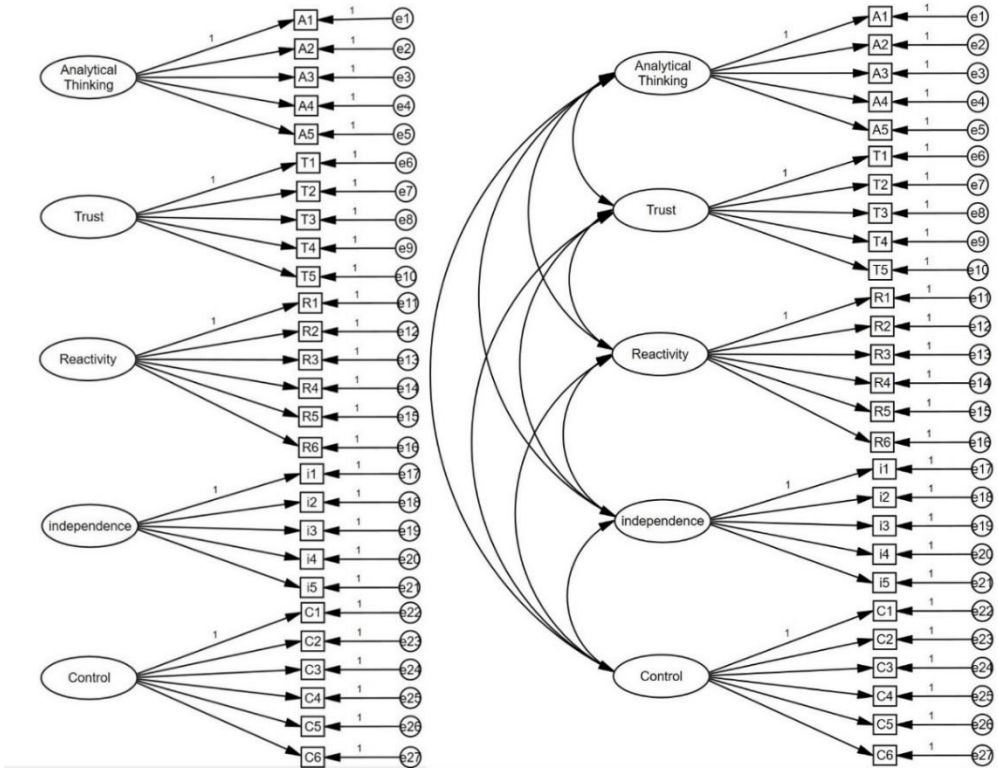

Figure 2. Path diagrams of A-TRiC orthogonal (left) and oblique models.

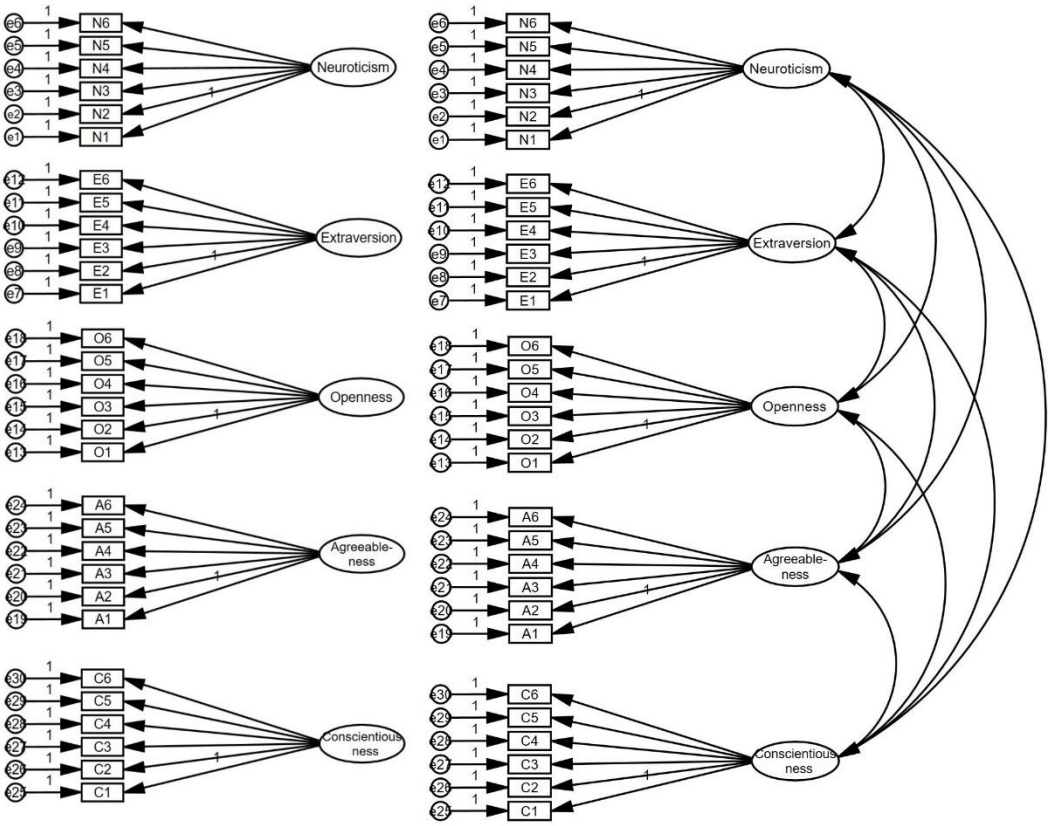

Figure 3. Path diagrams of NEO-PI-R orthogonal (left) and oblique models.

Table 5 displays model fit indices for the A-TRiC and NEO-PI-R for both orthogonal models and oblique models, with secondary loadings set to zero for both. As conventional model fit indices (except the TLI) are substantially affected by sample size (Marsh, Balla & McDonald, 1988), indices for the whole A-TRiC data (A-TRiC n1027) are shown alongside indices for the American normative sample for NEO-PI-R (NEO-PI-R n1000) (Aluja et al., 2005; Parker, Bagby & Summerfeldt, 1993), and the average values of three random samples of $N = 306$ from the A-TRiC dataset (A-TRiC n306), are shown with the NEO data (NEO-PI-R n306).

RMSEA values indicated a relatively good fit for the A-TRiC data but not for the NEO-PI-R datasets according to the conventional cut-off value of .05 (Hu & Bentler, 1999). For A-TRiC, the $\chi 2/df$ was close to 5, which is indicative of acceptable fit (Kline, 2015). None of the other fit indices indicated a good fit. Due to the hierarchical structure of NEO-PI-R, any item-level discrepancies remain invisible, as the facet scores take their place in the calculation of indices. Using such aggregate scores systematically inflates apparent model fit (Marsh, 2007).

Table 5

Model fit indices for A-TRiC and NEO-PI-R in three samples, for models with no secondary loadings.

		χ2	df	χ2/df	RMR	GFI	AGFI	NFI	CFI	RMSEA
Orth.	A-TRiC n1027	1658.25	324	5.12	.091	.884	.865	.744	.783	.063
	NEO-PI-R n1000	5674.39	405	14.01	.175*	.689	.642	.564	.581	.114
	A-TRiC n306	795.91	324	2.46	.102	.835	.807	.639	.746	.069
	NEO-PI-R n306	2263.96	405	5.59	.064	.644	.592	.506	.551	.123
Obl.	A-TRiC n1027	1417.24	314	4.51	.066	.899	.878	.782	.820	.059
	NEO-PI-R n1000	4866.07	395	12.32	.122*	.717	.666	.626	.645	.106
	A-TRiC n306	725.02	314	2.31	.081	.848	.817	.671	.778	.066
	NEO-PI-R n306	2056.37	395	5.21	.052	.659	.598	.551	.599	.117

Note. Orth.=Orthogonal model, Obl.=Oblique model, A-TRiC n1027=complete sample, A-TRiC n306=average of three random samples of 306 cases from complete data, NEO-PI-R n1000=normative sample, USA, NEO-PI-R n306=the NEO data, df=degrees of freedom, RMR=Root Mean Square Residual, GFI=Goodness of Fit Index, AGFI=Adjusted Goodness of Fit Index, NFI=Normed Fit Index, CFI=Comparative Fit Index, RMSEA=Root Mean Square Error of Approximation. *Values from Parker, Bagby & Summerfeldt (1993) due to error in Aluja et al. (2005), giving nonsensical results for RMR.

3.2 Predicted group differences

There were gender differences in Analytical Thinking $F(1,1014) = 106.1$, $p < .001$ and Control $F(1,1014) = 70.9$, $p < .001$ in the directions predicted, with males scoring higher on Analytical Thinking ($M_{male} = 2.93$, $M_{female} = 2.36$) and lower on Control than females ($M_{male} = 1.99$, $M_{female} =$

2.38). Cohen's *d* for the gender difference in Analytical Thinking was .682, and for Control it was .543, so the effect size was moderate for both.

252 participants reported being addicted to alcohol or some other substance causing strong, immediate sense of well-being. As predicted, they scored higher on Reactivity than those not admitting to being addicted $F(1,1021) = 25.8$, $p < .001$. Cohen's $d = .336$, so the effect size was very small.

481 participants reported having received a medical diagnosis of either depression or anxiety, or both. Compared to participants without diagnoses, there was a significant difference in their level of Reactivity $F(1,1023) = 18.7$, $p < .001$; Cohen's $d = .254$ and Control $F(1,1023) = 37.8$, $p < .001$; Cohen's d = .404 in the directions predicted, with higher scores on both traits for those with a diagnosis.

There was a difference in Analytical Thinking between groups with different types of education $F(3,1023) = 23.3$, $p < .001$. The level of Analytical Thinking was significantly higher, as expected, in those with an education in natural sciences, compared to those with an education in humanities/social/behavioural sciences (Bonferroni corrected $p < .001$; Cohen's $d = .721$) and those with a vocational education (Bonferroni corrected $p < .001$; Cohen's $d = .544$).

4 Discussion

The results give reason for cautionary optimism as to the plausibility of the proposed trait structure, despite mistakes made in this first attempt at operationalisation. These are discussed below. With the benefit of hindsight, all but one of the mistakes make sense within the original A-TRiC definitions. Naturally, internal consistency has to be validated in an independent sample, as some items with low correlations were dropped from the final version of the questionnaire, thereby raising average inter-item correlations for the A-TRiC traits in this sample.

4.1 Unexpected group differences

In addition to the predicted and reported gender differences, there were statistically significant but smaller differences in Independence and Reactivity, too, with men being more independent ($p = .009$, Cohen's $d = .168$) and women being more reactive ($p < .001$, Cohen's $d = .286$). The higher Reactivity is in line with results for the Neuroticism facet Angry Hostility, where seven of the eight items measure A-TRiC Reactivity. Women were higher on Angry Hostility in the NEO data ($p =$

.022, Cohen's d = .283) as well as in earlier studies (Costa, Terracciano & McCrae, 2001). There was no difference in Trust between men and women (p = .172).

In addition to the predicted differences in diagnosed depression and/or anxiety, higher Trust seems to offer slight protection from such mental problems (p < .001, Cohen's d = .340). A logical result, with the benefit of hindsight.

In addition to the predicted differences in Analytical Thinking, those with no education after primary and middle school also scored lower than those with an education in natural science (Bonferroni-corrected p = .011 Cohen's d = .425). It is interesting to note, that the difference was smaller than the differences between natural science vs. vocational education and natural science vs. humanities/behavioural/social science.

4.2 Lessons learned about the traits

The skewness of the distribution of scores on **Analytical Thinking** could be due to advertisement for the study on the Facebook site *Skepsis*, dedicated to sceptical discussion about science and pseudoscience, whereas no advertisements were placed on any sites embracing religion or mysticism. The items proved successful at keeping the measure clean from cross-contamination by other traits. This was far easier to achieve than with the other traits, as Analytical Thinking is clearly different in its stimulus space and the emotions it activates; it is about mechanistic curiosity, the objects of which are usually phenomena outside the social sphere. Mechanistic curiosity can also be found in individually varying amounts in other great apes (Uher, Asendorpf & Call, 2008), but naturally it comes to its own in us, who have evolved quite another level of conceptual cognitive abilities and fine motor skills.

There is no counterpart for Analytical Thinking in the FFM/B5, with the partial exception of B5 Intellect which, on the one hand, misses the emotional quality by concentrating on abilities like size of vocabulary, and on the other hand, misses the breadth of Analytical thinking by only focusing on the verbal and conceptual domains. NEO-PI-R contains no items measuring analytical thinking. So, it seems fair to say, that no attention is paid to this trait in contemporary mainstream personality research. This might be considered an oversight, given the importance of analytical thinking in education as well as the industrial-organizational sphere, where FFM/B5 tests are much used.

Some **Trust** items proved tainted by Reactivity. The quintessence of high Trust is a simple feeling of good will towards people, an experience of joy, warmth and relaxation in their midst, whereas low Trust turns out not to be suspicion and malevolence as hypothesized, but simply social wariness. For

true paranoid-type suspicion and a readiness to manipulate and take advantage of others, low Trust needs high Reactivity by its side.

This was the only case, where the empirical results gave reason to redefine one pole of the trait dimension somewhat. A more appropriate name for the trait would therefore be Affinity, but to avoid confusion, Trust will be used here.

An example of mistakes in operationalisation is the item *If I have information that is worth money, I keep it to myself.* In addition to being tainted by Reactivity in measuring the subjective importance of securing resources, it forced subjects to imagine situations where many of them have not been, so it ended up having low correlations with purer Trust items. As it only had two cross-correlations above .10 (logically with Reactivity items), it did map mainly onto Trust and was left in the final test, pending removal in future versions.

The core of **Reactivity** seems clear. It is a continuum ranging from zen-like calmness and flexible submission to a need for dominance and an almost constant vigilance: a smouldering, short fuse and a readiness to attack at the slightest hint of affront or frustration. Mapping the stimulus space is more challenging, but it seems safe to assume activation will be strongest to threats against social standing (one's perceived "rights") and against goal-directed behaviour.

The constant negative vigilance of the highly reactive person can only be alleviated by competing stimulation, be it external activity or the manipulation of neural chemistry with drugs, so it was assumed that Reactivity includes impatience, impulsiveness and proneness to boredom. According to the data, this seems to be the case. This association is corroborated by earlier research (Dahlen, Martin, Ragan & Kuhlman, 2004; Rupp & Vodanovich, 1997).

From the very beginning, **Independence** proved difficult to "purify". How can one formulate items that measure (reversed) need for social approval, but which are not tainted by the effects of Trust (wanting to be liked) or Reactivity (wanting to be respected and obeyed)? It seems I succeeded in the former, but not in the latter, as Independence and Reactivity did correlate moderately ($r = -.267$). Also, the item *I like being at the centre of attention* (reversed) measured Independence well, but cross-correlated with Control item *I enjoy peace and quiet* ($r = .235$), for obvious reasons.

The difficulty in keeping apart **Control** and Reactivity stems from the underlying ambience of wariness and vigilance that they share, which gives those with high levels of either trait an undercurrent of near-constant tension and negative experience. This is reflected in that the discarded, rather unspecific item *It feels like my body is constantly tense* correlated with both Reactivity ($r = .254$) and Control ($r = .393$).

In hindsight, the correlations between Reactivity and item C4 *Background noises disturb my concentration* (r = .267) and C5 *I get easily anxious, when I think about all that can happen in the future* (r = .245) seem logical, too, given the tense vigilance typical for both traits. The Reactivity item *I get frustrated if I'm in a hurry and someone is slowing me down* measured Reactivity well, but correlated with Control also, as it maps onto anger because of the obstacle between a person and his goal (Reactivity) as well as anguish about losing control over a situation by being late (Control).

4.3 Trait synergy – personality is more than the sum of traits

As the ruminations above show, careful thought is required to distil the truly independent essence of each trait. Due to the intricate ways in which the four social traits ("the TRiC") interact within each person, they will never be on display in their pure form. It is this focus on interaction and inter-trait modulation that is the true strength of A-TRiC. Below are a few examples of how the high and low extremes of the four traits theoretically modulate each other, beginning with a description of interactions that would produce some of the personality extremes given diagnostic status*. For brevity, plus and minus signs are used to denote high and low extremes, respectively, and first letters of trait names.

The combination -T+R comprises the minimum requirement for antisocial personality disorder (pd) or, depending on the clinician, paranoid pd. +R is enough for aggression, but -T is needed for the callousness that is part of the diagnostic criteria. -C adds impulsive externalizing into the mix, while -i in this context adds a strong desire for power over people, which is needed for narcissistic pd. Given enough cognitive skills, higher levels of C would make such a person methodical and restrained enough to be an asset for jobs where ruthlessness and (non-physical) aggression are appreciated. Such successful psychopathy is described by psychologists Babiak and Hare in their popular book *Snakes in Suits – When Psychopaths go to Work* (2006).

-T+i is the template for a social recluse, who is content by himself and doesn't care what others think of his choices. Such a combination could at its extreme lead to a schizoid pd diagnosis. Extreme -C can easily cause problems, as in combination with +R (borderline pd) or by otherwise exacerbating the effects of almost any personality disorder, but there is one diagnosis lurking at the extreme end of +C, too, namely obsessive-compulsive pd, especially in combination with -T. The only personality disorder characterized by extreme +T (with -i) is dependent pd, while histrionic pd

* My assumption here is to trust the slowly maturing consensus that the theory (such as it is) behind personality disorders is mistaken and that the ten categories given personality disorder labels have no ontological status outside the diagnostic manuals and offices of clinicians adhering to them. Instead, the view that personality traits are continua with normal distributions implies, that the outer extremes will be rare and often maladaptive. It also implies, that any complex mental manifestations deemed pathological, i.e., not simple disruptions of function, must be extremes of traits that we all have. For a review of the state of psychiatric diagnostics, see e.g. Haslam, Holland & Kuppens, 2012.

is an example of extreme -i (with -T). In fact, histrionic pd and schizoid pd form opposite ends of the Independence dimension, when keeping T constant.

Of course, many interesting outcomes outside psychopathology result from trait interactions. One example is risk-taking, which is modulated by C and R. A maximally risk-averse person will be +C-R, whereas +R will make risk-taking more likely, both due to proneness to boredom/need for stimulation and due to the easily flaring anger, which has been shown to be associated with greater risk-taking (Lerner & Keltner, 2001). According to A-TRiC therefore, impulsivity is not a unidimensional construct, but draws from two sources: R and C. In general, impulsivity is a rather fuzzy concept, measured in different ways, sometimes including both fast and "thoughtless" reactions to environmental stimuli *and* a propensity to act quickly on an internally generated idea (for an exhaustive review on impulsivity and constraint, see Carver, 2005), but its smallest common denominator is a readiness to do new things (-C) and a need for instant gratification (+R). The enabling effect of -C on both sensation-seeking and externalizing aggression provides a solution to the so-called "aggression paradox" (Joireman, Anderson, & Strathman, 2003), as it explains why externalizing aggression and impulsive sensation-seeking consistently correlate, despite being modelled as independent traits (García-Forero, Gallardo-Pujol, Maydeu-Olivares, & Andrés-Pueyo, 2009; Gomà-i-Freixanet, Valero, Puntí, & Zuckerman (2004); Zuckerman, Kuhlman, Joireman, Teta & Kraft, 1993).

Although +C and +R are each associated with a negative subjective experience, being +C might paradoxically make life somewhat easier to someone who is +R, as the need for control makes it less likely that the high reactivity leads to dire consequences due to impulsive risk-taking or externalized aggression or drug-taking. At the other extreme, being born +T-R+i-C is a true jackpot for mental well-being. This lucky person is a calm, adaptable, easy-going, resilient and trusting optimist who enjoys people, but is not dependent on their admiration or approval for his happiness. Less subjective well-being but more fun to be around is he who is +T-R-i-C: always ready for excitement and willing to do anything to make an impression on friends and acquaintances. Changing the polarity of R makes him assertive and a bit bossy, though.

It has long been recognized, that people react differently to reward and punishment. For some, (the expectation of) reward is a stronger motivator, while others respond more acutely to (a fear of) punishment (Carver & White, 1994). This is a logical result from different placement along the C continuum. Whereas low Independence is needed to be sensitive to both social reward and punishment, +C will make a person selectively more sensitive to punishment and -C makes him selectively more sensitive to reward. The most commonly used three-factor scale for reward sensitivity include items that, from an A-TRiC point of view, measure aspects of -i (Reward Responsiveness) -C (Fun Seeking) and a mixture of -i+R (Drive) (Carver & White, 1994). The

original reward sensitivity proposed by Gray (e.g. 1987) comes closer to describing effects of only C and i.

4.4 Anomalies of the FFM/B5 interpreted through the A-TRiC

As argued above (section 1.2), instead of mapping true traits of personality, it is conceivable that the FFM/B5 reveals consistent ways in which people evaluate others, and that Neuroticism is a factor resulting mainly from subjective preferences of the clinically oriented psychologists involved in the conception of the model. Also, the trait Openness/Intellect has been surrounded by controversy from its inception, when it was called Culture and loaded on concepts like socially polished, boorish, clumsy and aesthetically fastidious (Tupes & Christal, 1961). A whole Special Issue of The European Journal of Personality has been devoted to problems surrounding Openness/Intellect and given that even the Grand Old Man of the B5 calls the state of the trait an embarrassment (Goldberg, 1994), it will not be commented on any further here. Instead, the systematic psychometric anomalies of the remaining three traits will be examined within the framework of the A-TRiC.

4.4.1 Extraversion and Agreeableness

In the FFM/B5, affiliation (A-TRiC Trust), need for social reward (A-TRiC Independence) and assertiveness (A-TRiC Reactivity) are all parts of one domain, Extraversion. That they are indeed separate traits, gets corroboration in results from 39 nations (Lucas, Diener, Suh, Shao & Grob, 2000), and even earlier, Church (1994) showed that facets of Extraversion separate into three factors. One of them measures aspects of A-TRiC Trust (E1 Warmth and E6 Positive Emotions), another mainly Reactivity (E3 Assertiveness and E4 Activity) and the third a mix of Independence and Control (E2 Gregariousness and E5 Excitement-seeking). Elsewhere (Traupman et al., 2009), Extraversion and Agreeableness facets have been shown to coalesce over domain borders and form two factors that correspond to the two orthogonal axes of the Inter-Personal Circumplex: Control (dominance-submissiveness; roughly equivalent to Reactivity) and Affiliation (warmth-hostility; roughly equivalent to Trust).

In an exploratory factor analysis (Maximum Likelihood, Oblimin rotation) performed on the Extraversion items (NEO data, results not shown), nine factors of at least three items and loadings >.3 formed. The themes of the seven factors with reasonable interpretations were: 1. being cheerful, liking people, 2. disliking solitude or working alone, 3. being assertive, 4. being gregarious, 5. feeling joyful, laughing easily, 6. being in a hurry, being energetic and 7. enjoying talking to people, needing people around. With the conditions mentioned, no factor measuring warmth/affiliation formed. As assertiveness is dependent on high Reactivity and a baseline feeling of joyfulness and cheerfulness

depend on low Reactivity, A-TRiC predicts that factor 3 would correlate negatively with factors 1 and 5. Indeed, correlations were negative between the assertiveness factor and factor 1 (-.186) and factor 5 (-.104).

In an exploratory factor analysis (Maximum Likelihood, Oblimin rotation) of domain Agreeableness in the NEO data, facet A1 Trust remained intact and was unrelated to a factor formed around externalizing anger (r = .14), whereas there was a slightly higher correlation (r = .39) between A1 Trust and a factor formed around Machiavellian traits (results not shown). This pattern is expected, if Machiavellian malevolence and manipulation depend on both Trust and Reactivity, whereas externalizing anger depends on Reactivity only.

4.4.2 Conscientiousness

Some indirect evidence for the existence of a trait like Control comes from studies on the FFM/B5. Roberts, Chernyshenko, Stark and Goldberg (2005) as well as Jackson, Paunonen, Fraboni and Goffin (1996) have shown, that Conscientiousness splits into two factors, one measuring ambition (mainly A-TRiC Independence), the other measuring a need for control over one's environment (the essence of A-TRiC Control).

In an exploratory factor analysis (Maximum Likelihood, Oblimin rotation) performed on the Conscientiousness items, seven factors of at least three items with loadings >.3 formed (NEO data, results not shown). Their themes were: 1. being goal-oriented, efficient, 2. thinking before acting, 3. getting things done, 4. keeping thing in order, 5. being dependable, 6. being fastidious, prudent and 7. striving for achievement. All factors have an undercurrent of (low) Independence, a will to impress others. In addition, factors 2, 4 and 6 measure aspects of A-TRiC Control, while factor 7 measures mainly Reactivity (in the context of low Independence). The average correlation between the "Reactivity" factor and the "Control" factors was .083, while the "Control" factors had an average correlation of .281 amongst each other.

4.5 On the design of the A-TRiC questionnaire

A quick look at the literature shows that there exists no true consensus on, let alone knowledge about, what constitutes the best form, length, or type of content of personality tests (e.g. Bollen & Lennox, 1991; Burisch, 1984; Burisch, 1997; Clark & Watson, 1995). This is not surprising, if we assume we have not been measuring true traits of personality; no matter how non-coherent entities are measured, the results will always seem a bit off.

When measuring personality, we are trying to home in on subtle individual differences in neuroanatomy and synaptic dynamics. These differences are the necessary and sufficient substance

of personality (see section 1.3.2). Since they are unavailable to direct study with current technology, including imaging methods with their low functional resolution, we must make do with asking people for introspections on their emotional reactions, as these are the subjective results of the underlying neurophysiological and -anatomical differences – the last point upstream from where situational effects radically increase variability in behavioural reactions.

Specifically, the A-TRiC questionnaire attempts to measure the main traits in as pure a form as possible. The resulting profile then reveals the individual personality that arises from the multitude of interactions between the traits. Only a complete profile with an individual's placement on all traits, allows for prediction of real-life outcomes.

By focusing on emotions instead of overt behaviour when designing questionnaire items, two things can be achieved. First, one is dealing with a more unadulterated aspect of personality, and second, items about emotions may make it easier to answer honestly, as social desirability and cultural expectations focus on behaviour rather than feelings. As personality traits have evolved in very different circumstances than the ones we live in now, the best items will also be as "stone-age compatible" as possible. It is preferable to ask for reactions to generalizable situations and not describe specifically modern settings in the items. This has the added advantage of making the test maximally culture neutral.

The A-TRiC questionnaire contains no lie-scale and no items checking for absurd answering or inconsistencies due to a lapse of concentration or random answering. This is a decision made on partly subjective, partly theoretical grounds. I choose to believe, that a subject will answer truthfully, and due to the brevity of the questionnaire, will not space out either. My good faith in test takers stems less from my belief in human nature than from the way the A-TRiC questionnaire is designed. It differs from FFM/B5 tests in that there are very few morally laden items, and as only the complete profile reveals the personality that emerges from the interactions between the traits, the test remains rather opaque, despite its surface simplicity. I also believe negative wordings only confuse and make answering too "cognitive", as the subject will have to mentally rotate the scale 180 degrees before answering. Therefore, I chose not to strive for a strict balance between negative and positive wording, instead aiming at unambiguity and simple expression.

Poor consistency is typical for all personality tests and it is intuitively tempting to believe Epstein (1983) when he claims that personality traits are so broad, that they can only be measured with a large number of items that do not correlate too strongly with each other. Some researchers even give specific guidelines for appropriate correlations:

> "The .2 to .4 range of intercorrelations would seem to offer an acceptable balance between bandwidth on the one hand and fidelity on the other." (Briggs & Cheek, 1986, p. 114)

This statement, however, only applies if using a formative indicator measurement model, where the construct *is* the sum of its indicators. Then using a broad spectrum of items is what gives breadth to the latent construct and removing an item will narrow it down. But with such a model there is no reason to assume that the latent construct has any independent existence in the world. A truly independent and correctly defined unidimensional personality trait cannot be complex in a way that would preclude measuring it with only a few items (Bollen & Lennox, 1991).

The FFM/B5 and the A-TRiC both assume that personality traits are independent and unidimensional biological entities, which are measured by reflective indicators, i.e. the test items. From this follows, that any items comprising the facets and any facets comprising the domains, should be interchangeable. Advocates of the FFM/B5 defend the use of up to hundreds of items by stating that the "constructs measured are extremely broad" (McCrae & Costa, 1997, p. 588). This is not an acceptable defence, if they also maintain that their tests are measuring unidimensional independent entities.

A fear of (randomly) "imperfect" answering seems to me the only valid reason to use many items. The argument is, that items may arouse somewhat different representations in the mind of the test taker, but hopefully, with different formulations centring around the core of the construct itself, they will tend to average out on the correctish level for that person.

4.6 Why is the A-TRiC not hierarchical?

The concept of hierarchies in personality derives from the graphics of structural equation modelling (SEM), where correlations among latent constructs can be "resolved" by adding a second level of latent constructs representing those correlations. The FFM/B5 has taken advantage of this methodological possibility by adding a lower level of latent constructs into the model: the facets. This allows test designers to include large numbers of items relevant to real-world outcomes, which would not form the assumed five factors in exploratory factor analyses. Such hierarchies are a purely methodological construct, but it is often erroneously assumed they reflect information processing in the brain. This assumption leads to much faulty reasoning in psychology, so the issue deserves a few words.

Let's assume there exists a specific neural network for each FFM/B5 domain, that is activated by stimuli that are specific to it only. The intensity of network activity is modulated by stimulus strength, but all relevant stimuli cause qualitatively similar activity. This domain network's output is channelled to six facet networks, which all get activated to the same extent each time the domain network is activated, since there can't be any facet-specific filtering for stimuli at the level of the

domain. In such a case, the facet networks must get input from other neural systems downstream of sensory receptors but independent of domain network activity, and overriding the input from the domain network, so that only the appropriate facet activates the appropriate emotional state and behaviour, because all six facet networks can't be activated at once. If this is the case, then the facets are only situation-specific reactions to domain activation and the domain is the true trait.

If, on the other hand, a domain network itself responds *differently* to different relevant stimuli thereby activating only the appropriate facet network, it is functionally part of the facet, and independent of other facets. In this scenario, the facet is the trait and no domain exists.

As far as I can fathom, there can exist no possible organisation of brain networks that would be compatible with the psychometrically manifested hierarchy, so the law of parsimony dictates that hierarchies are an artefact of cross-correlations that are a result of poorly defined traits. These reflections should make it clear why A-TRiC has no hierarchical structure. Also, any substantial cross-correlations are signs of either faulty definition of the traits or badly formulated items.

Even though there can exist no hierarchies of latent constructs in the brain, there is one area, where the psychometric hierarchies of SEM may make sense: performance on IQ tests. Different areas of the brain solve different types of cognitive tests, but if solving all tests depends on the concurrent activity of one single "domain-general" functional network, like working memory for example, then a g-factor will emerge above the test-specific differences in performance. But this is due to a big conceptual difference between cognitive capacity and personality as phenomena. In IQ test performance, there is more or less of a thing; in personality we deal with thresholds to activation of several different emotion networks within trait-specific settings.

Likewise, talk about top-down and bottom-up systems easily leads us to assume types of activities that do not take place in the brain. The more synaptic waystations there are between sensory input and motor output, and the more networks that get activated, the more varied are the possible responses for a given input, but the basic structure is still always a chain with feedback and feedforward loops, not a hierarchy.

Any network within such a chain can of course be called the "top", but a serious mistake is made, if it is conceptualised as something that is independent of input – somehow able to become activated "at need". Such tops do not exist. This is because the activity of every single neuron at any given moment is a deterministic function of all incoming synaptic input[*]. The muddle becomes worse, when using dualistic expression like "a person can decide to X", where X implies, that the "person"

[*] The trivial exceptions to this rule are sensory cells that react to whatever modality of energy or type of non-synaptic molecule they are attuned to.

is some qualitatively different entity that can affect brain network activities downstream without itself being fully determined by upstream activity.

4.7 Why are emotions so central for the A-TRiC?

The A-TRiC questionnaire focuses on emotional reactions both because emotions are upstream from behaviour and because emotions have a more central role in behaviour than is often assumed. Emotion precedes all complex action. People with damage to their ventromedial orbitofrontal cortex lack the emotional component of decision-making and are unable to make up their minds in the simplest of situations, despite being otherwise cognitively normal and quite able to verbalize the pros and cons of alternatives (Bechara, Tranel, Damasio & Damasio, 1996).

The human brain is superbly able to process conceptual information, but it is unable to cause action if the result of conceptual cogitations is not accompanied by an emotional reaction. Humans come to a virtual standstill when trying to decide on a rational basis only. Rationality comes second, as an afterthought. It may sway us in small things, when all relevant information can be held active in working memory, but decisions requiring massive parallel processing can only be made based on the emotions which the (unconscious) processing activates.

When we let go of the old belief about rationality as a non-overlapping alternative to emotionality, this becomes self-evident: if no alternative *feels* even slightly better or worse than any other, how could we decide? Rationality allows us to process information, but it can never be the ultimate and only cause of behaviour. Emotions, therefore, make complex goal-directed behaviour possible and at the same time they restrict the repertoire of possible (or at least plausible) behaviours in a certain context.

Since human brains can simulate situations and these simulations themselves arouse emotions, we can maintain long-term goals and motives. The simulations allow us to behave in ways that do not immediately produce positive experiences, as long as we believe they will make us end up in a situation that does. Naturally, the emotions aroused by the simulations depend on personality. Someone low on Independence and high on Trust is unlikely to feel motivated to work hard to be able to buy a cabin and live alone in the remote wilderness.

Taking at face value the underlying assumptions of A-TRiC (see section 1.3.2) and understanding that there are no "tops" in the brain (see previous section) implies, that it is not possible for anyone to "control their emotions". The fact that people differ in the threshold of activation and the acceleration of their emotional state, easily gives the impression there exists such a capability. If person A is low on Reactivity and B is very reactive, an outside observer (and person A, too) will

interpret B's sensitivity to a situation where A remains calm as B's inability to control his emotions when in fact the difference is in the magnitude and valence of emotions activated in each individual by the situation. If A would be put into a situation where his emotional state would match B's, A could exert no more control than B in the first situation. The difference is in the innate thresholds of emotion activation, not in any ability to control emotions.

A highly reactive person can no more stop himself from feeling anger when confronted, than a highly trusting person can stop himself from feeling joy at meeting a dear friend. It is therefore unhelpful to tell someone with high levels of Reactivity to just stay calm, as such a modification of emotional reactions is impossible. The only recourse is to modify the environment to better fit one's personality; to avoid as best one can, situations where angers will flair and anxieties blossom. What makes these people less likely to encounter negative experiences and the repercussions in the form of chronic stress, depression, anxiety and substance abuse, may even go against much of that, which western society and psychotherapy deem to be good and desirable.

That innate traits can produce so much personal suffering, is yet an example of how natural selection "cares" not for our happiness, only about genes getting passed on from generation to generation. Acknowledging all this could lead to increased understanding for people with "difficult" personalities and be liberating to those who are born with such personalities. Although they cannot will themselves to become Shiny Happy People, they can escape some of the suffering by adjusting their circumstances to keep away from the stimulus spaces that activate the worst of their character.

4.8 On the temperament-personality dichotomy

Temperament researchers, who mainly concentrate on infants, come close to describing traits akin to the A-TRiC (with the exception of Analytical Thinking, for obvious reasons). I believe this is because it is easier to view pre-linguistic infants as alien creatures and this gives the researchers a clearer view of the traits, unencumbered by introspective comparisons. Those who study adult personality easily become affected by the intricacies of their own subjective experience and that, which was rather simple and straightforward in infants, is assumed to be immensely complex in adults.

I believe it is a mistake to think adult personality is made of more complex stuff than infant temperament. In fact, the most parsimonious assumption is, that there is no true difference between them, apart from gradual ontogenetic change in the way language and learning modulate how the traits manifest themselves in behaviour. The very human propensity to conjure up different reasons for our actions and reactions in different situations, causes the basic simplicity of the traits to

disappear from view. When the superficial complexities are ignored, however, temperament and personality become concepts with identical meaning.

Personality could of course be broadened to include individual habits, schemas and different roles assumed in different social settings, but I believe that the scientific buck stops at inter-individual differences in emotional responses to specific input. Beyond that, idiosyncratic and culturally influenced behaviour take over, and while these are valuable objects of study in themselves, rather than belonging within the scope of personality alone, they are a function of individual personality *and* life history in a certain cultural setting.

The temperament-personality dichotomy may survive also because researchers who try to associate traits with brain chemistry often call their object of study *temperament*, while those who approach the subject from a more behavioural vantage point, tend to call their object of study *personality*. But the difference is in the viewpoint, not the phenomenon they study.

4.9 On validity

The question whether the FFM/B5 traits exist, is not as straightforward as it may seem. The pragmatic answer is "Of course they exist – they are measured in psychology labs and businesses all over the world all the time". This answer is correct when *trait* is shorthand for any cluster of items. In such a **formative model**, a trait is measured into existence – it is simply the sum of items, given a name. Using this definition of a trait, every test measuring it must be valid in the trivial sense of measuring "what it purports to measure" (Kelley, 1927, p. 14). In such a case, however, validity as a concept loses its meaning.

But the FFM/B5 does not claim that its traits exist in this purely psychometric-epistemological sense. It is, like A-TRiC, a **reflective model** of the classical test theory ilk. Specifically, the FFM/B5 claims that the five domains are actual entities that causally affect thirty actual entities, which in turn cause individually varied behaviours and ways of thinking and feeling that are measured with the questionnaire items. It sees traits as "biologically based properties of the individual" (McCrae & Costa, 2008, p. 278).

True validity is ontological, not epistemological. Despite the multitude of validities in statistical parlance, it all boils down to accurate and reliable measurement of a construct *that exists independently of the measurement* (Borsboom, Mellenbergh & van Heerden, 2004). Psychometric methods can only corroborate or refute the existence of a trait *as it has been defined*. In the words of Borsboom et al. (2004, p. 1062):

> "It is important to note that [..] the problem of validity cannot be solved by psychometric techniques or models alone. On the contrary, it must be addressed by substantive theory."

Therefore, the substantive theory of A-TRiC and its underlying assumptions have been outlined in this thesis and psychometric measures were applied only to test its operationalisation.

4.10 Saving face by turning coats – the future of the FFM/B5

The story of the FFM/B5 has evolved from humble beginnings, when the ambiguities and severe problems were honestly admitted, to an assertive hubris, where the model is seen as a true and comprehensive description of human personality. However, no substantive improvements in the model have taken place during that time.

In the face of growing criticism, some FFM/B5 proponents have started leaning toward a formative interpretation, at least on the domain level. In 2017 Allik et al. stated that "NEO-PI-R is designed to measure 30 distinctive personality traits, *which are grouped into* Neuroticism, Extraversion, Openness, Agreeableness, and Conscientiousness domains" (p. 402, emphasis added). Lately, even McCrae (2015) has suggested such a U-turn; instead of domains causing facets, he suggests that the domains' existence is a result of facet covariances, i.e. a purely psychometric phenomenon. These suggestions are very different from the original claim, that domains are independent biological entities which cause variation in behaviour which can be grouped into facets.

Some proponents of the FFM/B5 have recently distanced themselves from the claim that the FFM/B5 is a description of human personality, and instead demoted it to "a nearly universally accepted approach to explaining *how individuals typically describe* their own or somebody else's *personality*" (Allik, Hrebícková & Realo, 2018, p. 1, emphasis added). Among those who believe we are not measuring true personality with the FFM/B5 tests, many still wish to keep using them due to their perceived usefulness (e.g. Boag, 2011). This way of thinking made the Ptolemaic view of the solar system survive for centuries past its expiration date, being equipped with ever more complex equants and epicycles to accommodate for all the data contradicting it. Such resistance to change is very human, but it has no place in science.

4.11 Finally

My goal has been to show that psychology needs a credible, *substantive* theory on the structure of personality – one that is built on what we know about the evolutionary history of our species and about the brain. Due to methodological restrictions, very little is known about the brain processes

behind any conscious experiences, so we need not concern ourselves with the nuts and bolts of neuroanatomy and transmitter dynamics, yet. But we absolutely need to factor in issues of evolvability; what types of inter-individually varying reactivities could have evolved in us, given the phylogenetic constraints on brain evolution, given what is common among all mammals, and given our unique history since our lineage split from the other great apes and acquired unprecedented cognitive capacities, including conceptual thinking and language.

That this thesis has included a critique of the prevailing model of personality, has been a conscious choice. It earns me no friends, but I share with Meehl the conviction, that scientific knowledge can only accumulate when old theories are dispassionately and explicitly abandoned when better ones are formulated (1978). Once there exists a situation, where the same phenomenon is described and explained by more than one theory, the whole field should concentrate on getting rid of them, until only the most parsimonious one remains. After that, no effort should be spared to formulate an even better one.

The A-TRiC is a first attempt at a theory on human personality that takes into consideration the evolutionary history of our species and the phylogenetic constraints on the brain. Whether the A-TRiC is right on target, partly correct, or completely wrong, time will hopefully tell. By far the worst fate that may befall the A-TRiC is that it is never put to the test, never attacked – just added to the long list of untested theories in psychology.

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Appendix 1

History of the Five-Factor Model and Big Five

The official history of FFM/B5 is usually built along the following temporal storyline: Galton formulates the hypothesis that natural language contains the words for all important personality traits. Allport and Odbert excavate the trait words from amongst the half million entries in the Webster's New Unabridged International Dictionary. Cattell and colleagues perform the Sisyphean feat of distilling out the truly focal adjectives by factor analysis and end up with twelve traits. Finally, several psychologists re-analyse Cattell's data, and the number of traits narrows down to five. Ever since, the field is divided amicably between those preferring to use lists of adjectives to measure the Big Five and those inclined to use whole sentences describing everyday behaviours supposedly reflecting the underlying traits. The winner of minds and market shares is the FFM as operationalised by Costa and McCrae in the NEO PI-R. When zooming in a bit closer, a more complex picture emerges.

Often the work of Cattell is left in the shadow of Allport and Odbert, as if he just crunched the numbers on the 4504 terms Allport and Odbert had singled out as true trait words. In truth, his work was far more influential. First, on purely subjective grounds, Cattell rejected hundreds of the original adjectives as too vague and added a few hundred words he felt should be included (Cattell, 1943). A literary student and a psychologist were then given the task to form clusters of synonyms from these words, and finally they converged on around two hundred clusters (Cattell, 1943). As the clusters "passed continuously one into another" (Cattell, 1943, p. 488), the trio collectively decided where the "natural nuclei" of the clouds of words were located, with right of veto for Cattell. This is the second instance of subjective modification of the original list of words.

Most traits were defined by clusters of opposites. This presented a third instance, where subjective choices by Cattell played a critical part, as the poles forming the opposites were inherently ambiguous. In Cattell's words: "Is the opposite of bullying, sadistic, etc., to be considered as just nonbullying or as protective or as masochistic? Is impulsive the opposite of self-controlled or of phlegmatic?" (Cattell, 1943, p. 489).

Finally, Cattell had narrowed down the number of categories to around 160 with an average 13.4 adjectives per category. He now added clinical terminology coined during the past hundred years, and also ten specific cognitive abilities. In the end, he had a list of 171 mostly bipolar trait descriptors, beginning with Alert vs Absent-minded and ending in Worrying vs Placid (Cattell, 1943).

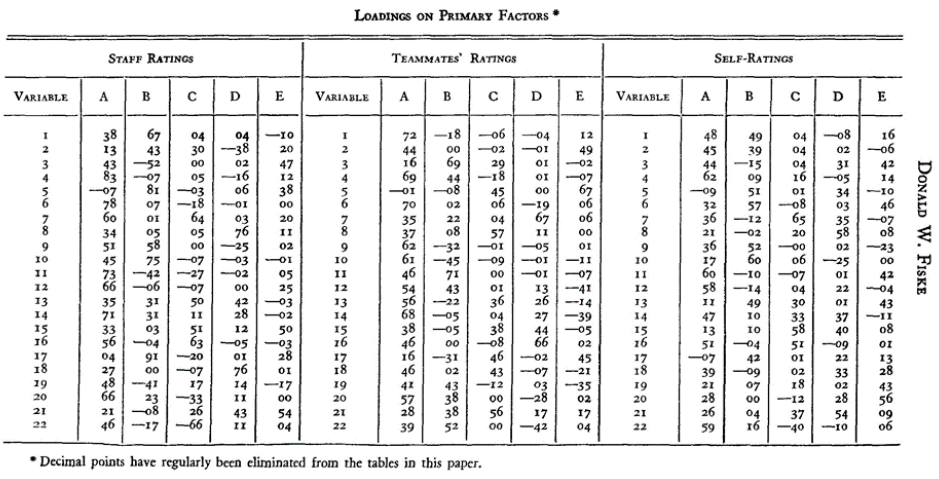
In the first study, this list was used for peer ratings by a hundred men. Cattell enthused about being able to avoid the homogeneity of typical samples marked by "overrepresentation of intelligent, professional, and indeed academic types", as his sample contained "domestic servants, janitors, artisans, a lumber jack, a Nova Scotian fisherman, and so on" (Cattell, 1943, p. 497). The resulting correlation matrix, four by four meters in size, was analysed by grouping adjectives into clusters where correlations were at least .45 between all elements. His aim was to locate 30-40 clusters that together contained all 171 trait terms, as a higher number of clusters would have been impossible to factor analyse in those days. Even after having cleaned the material of more than 95% of the original trait descriptors, he had no such luck:

> "The ideal cluster, as a set of highly intercorrelating variables, each of which is far more highly correlated with its fellow cluster members than with any outside variable, does not exist in nature. One deals rather with a continuous, straggling network of large and small and more or less overlapping clusters." (Cattell, 1943, p. 498)

Instead of a neat collection of 30-40 clusters including all adjectives, Cattell ended up with "a few" clusters with 6-12 adjectives, 15 with five adjectives, 20 with four and 88 consisting of three adjectives with correlations of at least .45 (Cattell, 1943). 135 of the original 171 adjectives were included in these clusters. Four of the rejected 36 adjectives were

included in their closest three-member clusters due to their "importance", despite lower correlation (Cattell, 1943). For the factor analysis, Cattell neglected some smaller clusters, combined clusters with large overlap in correlations and chose from the reminder only those "already confirmed by other researchers" (Cattell, 1945, p. 71). Now he had 35 cluster variables, which 208 men used to rate their peers with. After factor analysis of the results Cattell ended up with 12 traits (Cattell, 1945).

Choosing 22 of these 35 cluster variables, Fiske (1949) found five factors. A closer look at the results from his three samples (1949) reveals a different picture. If we apply the condition that a variable must have a loading of >.3 on its main factor and to not have cross-loadings that are within |.29| of its main factor loading, it becomes apparent that none of the factors had any variables in common in all three studies (Figure 4). Factor C had no variable loadings filling that requirement, while factor E did have two variables, but in only one of the three samples.



LOADINGS ON PRIMARY FACTORS *

STAFF RATINGS						TEAMMATES' RATINGS						SELF-RATINGS					
VARIABLE	A	B	C	D	E	VARIABLE	A	B	C	D	E	VARIABLE	A	B	C	D	E
1	38	67	04	04	−10	1	72	−18	−06	−04	12	1	48	49	04	−08	16
2	13	43	30	−38	20	2	44	00	−02	−01	49	2	45	39	04	02	−06
3	43	−52	00	02	47	3	16	69	29	01	−02	3	44	−15	04	31	42
4	83	−07	05	−16	12	4	69	44	−18	01	−07	4	62	09	16	−05	14
5	−07	81	−03	06	38	5	−01	−08	45	00	67	5	−09	51	01	34	−10
6	78	07	−18	−01	00	6	70	02	06	−19	06	6	32	57	−08	03	46
7	60	01	64	03	20	7	35	22	04	67	06	7	36	−12	65	35	−07
8	34	05	05	76	11	8	37	08	57	11	00	8	21	−02	20	58	08
9	51	58	00	−25	02	9	62	−32	−01	−05	01	9	36	52	−00	02	−23
10	45	75	−07	−03	−01	10	61	−45	−09	−01	−11	10	17	60	06	−25	00
11	73	−42	−27	−02	05	11	46	71	00	−01	−07	11	60	−10	−07	01	42
12	66	−06	−07	00	25	12	54	43	01	13	−41	12	58	−14	04	22	−04
13	35	31	50	42	−03	13	56	−22	36	26	−14	13	11	49	30	01	43
14	71	31	11	28	−02	14	68	−05	04	27	−39	14	47	10	33	37	−11
15	33	03	51	12	50	15	38	−05	38	44	−05	15	13	10	58	40	08
16	56	−04	63	−05	−03	16	46	00	−08	66	02	16	51	−04	51	−09	01
17	04	91	−20	01	28	17	16	−31	46	−02	45	17	−07	42	01	22	13
18	27	00	−07	76	01	18	46	02	43	−07	−21	18	39	−09	02	33	28
19	48	−41	17	14	−17	19	41	43	−12	03	−35	19	21	07	18	02	43
20	66	23	−33	11	00	20	57	38	00	−28	02	20	28	00	−12	28	56
21	21	−08	26	43	54	21	28	38	56	17	17	21	26	04	37	54	09
22	46	−17	−66	11	04	22	39	52	00	−42	04	22	59	16	−40	−10	06

* Decimal points have regularly been eliminated from the tables in this paper.

DONALD W. FISKE

Figure 4. Factor matrices from three samples for five factor solution with 22 of Cattell's 35 variables. Reprinted from "Consistency of the factorial structures of personality ratings from different sources." By D. W. Fiske, 1949, Journal of Abnormal and Social Psychology, 44, 334. Copyright 2018 by the American Psychological Association.

Tupes and Christal (1961) chose 30 of 35 Cattellian variables for their study, and now the pattern of loadings did resemble the later Big Five. They named the factors (highest loading trait words in parentheses) Surgency (talkativeness, assertiveness, adventurousness), Agreeableness (good-natured, lack of jealousy, emotionally mature), Conscientiousness (orderliness, responsibility, conscientiousness), Emotional Stability (not neurotic, placid, not hypochondriacal), Culture (artistic, culture, polished). Importantly, Tupes and Christal (1961) only ever looked for five traits, neither more nor less, so there is no information on whether any other solution had fit the data better. From here on, the five factors were taken for granted, and only such variables chosen, that supported this structure (Norman, 1963; Digman & Takemoto-Chock, 1981).

The only underlying assumption behind FFM/B5 is, that trait words in language, when used by people to describe themselves and others, will reveal through factor analysis the nature of the traits that make up human personality. Throughout the process of looking for the traits, however, several purely subjective decisions were made by psychologists as to which words should be included and discarded; how to place the "centres" of the traits; which opposite poles the trait continua stretched between, etc. These subjective decisions are critical for the simple reason that the FFM/B5 does not have any (other) theoretical basis. It stands (and falls) with the lexical hypothesis, so picking and choosing among trait words is not an option, unless one chooses to discard the lexical hypothesis also.

The theoretical problems with the lexical approach are addressed in 1.2, but even assuming its validity, it is clear, that any traits that appear are absolutely determined by the available words/items that subjects are given. As Peabody and Goldberg put it:

> "The selection of variables is clearly of critical importance, serving to determine the very presence of a factor, as well as its size and content. Indeed, the selection of variables is the method used to establish particular personality characteristics." (Peabody & Goldberg, 1989, p. 553).

When trait words are subjectively chosen according to professional hunches and with the purpose of giving a clean structure based on earlier results from factor analyses, such a structure is bound to keep appearing in the future, too. There is no reason, on these grounds, to believe it reflects human universal personality. Early proponents of the FFM/B5 emphatically state, that they do not believe the lexical taxonomy reveals the true structure of personality (Fiske, 1949; Tupes & Christal, 1961; Norman, 1963), but as the messy beginnings of the FFM/B5 disappeared in the haze of history, certainty grew among the younger generation, until they were ready to pronounce their model a comprehensive and valid description of universal human personality (e.g. McCrae, 2002).

Appendix 2 The questionnaire

Vastaa seuraaviin väittämiin valitsemalla vaihtoehto, joka on lähinnä omaa näkemystäsi.

Jos väittämä *ei päde sinuun lainkaan* tai olet *täysin eri mieltä*, valitse "**Ei ikinä**".

Jos väittämä *pätee sinuun harvoin* tai olet vain *vähän samaa mieltä*, valitse "**Harvoin**"

Jos väittämä pätee sinuun yhtä usein kun on pätemättäkin tai et ole sen paremmin samaa mieltä kuin eri mieltäkään, valitse "**Joskus**".

Jos väittämä pätee sinuun usein tai olet *melko samaa mieltä*, valitse "**Usein**".

Jos väittämä *pätee sinuun aina* tai *olet täysin samaa mieltä*, valitse "**Aina**".

	Ei ikinä	Harvoin	Joskus	Usein	Aina
Olen sen verran tarkka ihmisten kanssa, että minua ei ole helppo huijata.	○	○	○	○	○
Minua ärsyttää, jos en ymmärrä jotakin kiinnostavaa ilmiötä täysin.	○	○	○	○	○
Pidän melkein kaikista ihmisistä.	○	○	○	○	○
Hermostun helposti, jos minulla on kiire ja joku hidastelee.	○	○	○	○	○
Olisin mielelläni kuuluisa ja ihailtu.	○	○	○	○	○
Yllättäen tapahtuvat muutokset suunnitelmiin ärsyttävät minua.	○	○	○	○	○
Haluan tietää, miten asiat oikeasti toimivat, eli mitkä mekanismit ovat niiden taustalla.	○	○	○	○	○
Minun on opittava tuntemaan ihminen hyvin, ennen kuin alan luottaa häneen.	○	○	○	○	○
Minusta tuntuu, kuin kehoni olisi koko ajan vähän jännittynyt.	○	○	○	○	○
Minulle on tärkeää, että ihmiset arvostavat minua.	○	○	○	○	○
Pidän siitä, että en tiedä, mitä huominen tuo tullessaan.	○	○	○	○	○
Saatan uppoutua pitkiksi ajoiksi tutkimaan jotakin aihetta tai ongelmaa.	○	○	○	○	○
Luotan ihmisiin.	○	○	○	○	○
Sanon tai teen vihaisena helposti asioita, joita kadun myöhemmin.	○	○	○	○	○
Haluaisin olla huipulla omalla alallani.	○	○	○	○	○
Nautin rauhasta ja ennakoitavuudesta.	○	○	○	○	○
Minua kiinnostavat enemmän hengelliset tai filosofiset kysymykset kuin tiede tai tekniikka.	○	○	○	○	○
Minusta on selvää, että ihmiset ajavat aina omia etujaan.	○	○	○	○	○
Ympäristön hälinä häiritsee helposti keskittymistäni.	○	○	○	○	○
Jos minulla olisi joku erityinen taito, olisin mielelläni esiintyvä taiteilija.	○	○	○	○	○
Teen tarkat pakkauslistat, kun lähden matkalle.	○	○	○	○	○
Pidän siitä, kun jonkin ilmiön taustalta löytyy looginen ja aukoton selitys.	○	○	○	○	○
Jos minulla on rahanarvoista tietoa, pidän sen itselläni.	○	○	○	○	○
Kiivastun helposti, jos asiat eivät suju kuten toivon.	○	○	○	○	○
Olen halukas tekemään paljon, jotta minua kunnioitetaan.	○	○	○	○	○
Innostun nopeasti uusista asioista.	○	○	○	○	○
Uskon enemmän intuitioon kuin asioiden pikkutarkkaan analysointiin.	○	○	○	○	○
Jos joku on pettänyt luottamukseni kerran, en luota häneen enää.	○	○	○	○	○
En pidä kovista äänistä.	○	○	○	○	○
Arvostan eniten omaa vapauttani tehdä mitä haluan, en muiden mielipiteitä.	○	○	○	○	○
Rutiinit rauhoittavat mieleni.	○	○	○	○	○
Minusta on mukavaa, että on olemassa mystisiä ilmiöitä, joita ei voi tieteellisesti selvittää.	○	○	○	○	○
Huomaan heti, jos toinen ihminen on ottava osapuoli sosiaalisissa tilanteissa.	○	○	○	○	○
Ahdistun helposti, kun ajattelen, mitä kaikkea voi tulevaisuudessa tapahtua.	○	○	○	○	○
Teen usein asioita saadakseni hyväksyntää.	○	○	○	○	○
Janoan jatkuvasti uusia elämyksiä.	○	○	○	○	○

A-TRIC SIVU 2(3)

Vastaa seuraaviin väittämiin valitsemalla vaihtoehto, joka on lähinnä omaa näkemystäsi.

Jos väittämä *ei päde sinuun lainkaan* tai olet *täysin eri mieltä*, valitse "**Ei ikinä**".

Jos väittämä *pätee sinuun harvoin* tai olet vain *vähän samaa mieltä*, valitse "**Harvoin**"

Jos väittämä pätee sinuun yhtä usein kun on pätemättäkin tai et ole sen paremmin samaa mieltä kuin eri mieltäkään, valitse "**Joskus**".

Jos väittämä pätee sinuun usein tai olet *melko samaa mieltä*, valitse "**Usein**".

Jos väittämä *pätee sinuun aina* tai *olet täysin samaa mieltä*, valitse "**Aina**".

	Ei ikinä	Harvoin	Joskus	Usein	Aina
Olen ujo.	○	○	○	○	○
Olen kärsimätön.	○	○	○	○	○
Olen itsepäinen.	○	○	○	○	○
Tunnen helposti syyllisyyttä.	○	○	○	○	○
En ajattele muiden kärsimyksiä.	○	○	○	○	○
Minusta on epämiellyttävää olla kiitollisuudenvelassa.	○	○	○	○	○
Pidän koirista tai kissoista.	○	○	○	○	○
Pidän itsestäni.	○	○	○	○	○
Olen tyytyväinen elämääni.	○	○	○	○	○
En pidä pienistä lapsista.	○	○	○	○	○
Liikutun helposti kyyneliin asti.	○	○	○	○	○
Nautin, kun ympärilläni on paljon ihmisiä.	○	○	○	○	○
Haluaisin aseman, jossa minua totellaan kyselemättä.	○	○	○	○	○
Minua inhottavat herkästi eritteet, kuten märkivät haavat, veri, lima, uloste.	○	○	○	○	○
Kyllästyn helposti.	○	○	○	○	○
Haluan olla huomion keskipisteenä.	○	○	○	○	○
En antaisi rahaa kerjäläiselle.	○	○	○	○	○
En pode syyllisyyttä, jos olen aiheuttanut jollekin mielipahaa – menneet ovat menneitä.	○	○	○	○	○
En siedä epäjärjestystä ympäristössäni.	○	○	○	○	○
Liikkeeni ovat nopeita, etenkin kun teen rutiiniasioita.	○	○	○	○	○
Inhoan tunnetta, kun joku vaatekappale kiristää jostakin tai sukka on kierossa.	○	○	○	○	○
Minun on vaikea sitoutua pitkäaikaiseen parisuhteeseen, koska ”kipinä katoaa”.	○	○	○	○	○
Pidän eniten ihmissuhteita käsittelevistä elokuvista/TV-sarjoista/kirjoista.	○	○	○	○	○
Kun ajattelen tulevaisuutta, mietin aina tarkkaan, mikä voisi mennä pieleen.	○	○	○	○	○
Nautin siitä, että ympäristöni on siisti ja tiedän, missä kaikki tavarani ovat.	○	○	○	○	○
Käyn usein mielessäni läpi sosiaalisia tilanteita, joissa olen ollut tai joihin saatan joutua ja ”harjoittelen” mielessäni erilaisia vuorosanoja tai tekoja.	○	○	○	○	○
Olen säästäväinen.	○	○	○	○	○
Minua ei haittaa, jos joku kärsii, kun pyrin saavuttamaan tärkeät tavoitteeni.	○	○	○	○	○
En kärsi huonosta omatunnosta koskaan.	○	○	○	○	○
Jos maailmaa laitettaisiin johtamaan yksinvaltias, olisin hyvä siinä hommassa.	○	○	○	○	○

A-TRIC SIVU 3(3)

Vastaa seuraaviin väittämiin valitsemalla vaihtoehto, joka on lähinnä omaa näkemystäsi.

Jos väittämä *ei päde sinuun lainkaan* tai olet *täysin eri mieltä*, valitse "**Ei ikinä**".

Jos väittämä *pätee sinuun harvoin* tai olet vain *vähän samaa mieltä*, valitse "**Harvoin**"

Jos väittämä pätee sinuun yhtä usein kun on pätemättäkin tai et ole sen paremmin samaa mieltä kuin eri mieltäkään, valitse "**Joskus**".

Jos väittämä pätee sinuun usein tai olet *melko samaa mieltä*, valitse "**Usein**".

Jos väittämä *pätee sinuun aina* tai *olet täysin samaa mieltä*, valitse "**Aina**".

	Ei ikinä	Harvoin	Joskus	Usein	Aina
Jos näen vinossa riippuvan taulun, tunnen tarvetta oikaista se.	○	○	○	○	○
Kärsin usein vatsavaivoista.	○	○	○	○	○
Minulla on pakkoliikkeitä (kuten silmien räpyttelyä, tai ääntelyä, tai lihasten nykimistä kasvoissa, niskassa, hartioissa tai käsissä).	○	○	○	○	○
Pureskelen kynsiäni/kynsinauhojani tai nypin irti hiuksiani.	○	○	○	○	○
Jos minulla on finni tai muu kohouma ihossa, haluan nyppiä sen pois heti.	○	○	○	○	○
Olen joskus saanut ahdistushäiriö- ja/tai masennusdiagnoosin. ("Ei ikinä"=ei diagnoosia, "Harvoin"= ahdistushäiriö, "Usein"=masennus, "Aina"=kummatkin)	○	○	○	○	○
Epäilen usein, että joku haluaa minulle pahaa, vaikka muut väittäisivät että vain kuvittelen.	○	○	○	○	○
Syön helposti liikaa, kun syön jotain seuraavista: jäätelö, suklaa, leivonnaiset, sipsit, makeiset, suolapähkinät tai jotain muuta suolaisen ja rasvaisen TAI makean ja rasvaisen yhdistelmää.	○	○	○	○	○
Uskon, että voisin helposti tulla riippuvaiseksi alkoholista tai jostakin muusta aineesta, joka tuottaa nopeasti hyvää oloa.	○	○	○	○	○
Olen riippuvainen alkoholista tai jostakin muusta aineesta, joka tuottaa nopeasti hyvää oloa.	○	○	○	○	○
Minua alkavat helposti ärsyttää tietyt ihmisten tuottamat toistuvat äänet, esimerkiksi kun he syövät jotain, tai naputtelevat sormillaan, yskivät tai selvittävät kurkkuaan	○	○	○	○	○
Uskon, että minulla on tärkeä tehtävä elämässäni	○	○	○	○	○
Uskon, että on olemassa jumala tai joku kosminen energia/voima, joka voi tietoisesti ohjata tapahtumia maapallolla.	○	○	○	○	○
Harvat ymmärtävät, miten erityislaatuinen ihminen oikeasti olen.	○	○	○	○	○
Oma perhe on minulle tärkeämpi kuin kaikki muut ihmiset maailmassa yhteensä.	○	○	○	○	○
Mielestäni on parempi, että eri kulttuureista tulevat ihmiset eivät sekoitu keskenään.	○	○	○	○	○
Mielestäni yhteiskunnan tulee taata siedettävä ja ihmisarvoinen elämä kaikille, riippumatta heidän ominaisuuksistaan.	○	○	○	○	○
Uskon, että jokainen on yksin vastuussa omasta onnistumisestaan elämässä.	○	○	○	○	○
Kämmeneni hikoavat helposti.	○	○	○	○	○
Tunnen vetoa riskisijoituksiin tai uhkapeleihin, etenkin kun panokset ovat korkeat.	○	○	○	○	○

TAUSTATIEDOT

Sukupuoli: Nainen ▼

Ikä:

Koulutus ?: Peruskoulu ▼

Koulutusala ?: Humanistinen, käyttäytymistieteellinen tai yhteiskuntatieteellinen ▼

Ammatti ?: Opiskelija ▼

Onko sinulla lapsia?: Ei ▼

Keksi itsellesi salasana, jolla saat tuloksesi. Kirjoita se tähän ja itsellesi muistiin. ?

Tämä ohjelma ei ikävä kyllä tarjoa automaattista testipalautetta. Jos haluat tietää oman testituloksesi anonymiteettisi säilyttäen, toimi näin:

Kirjoita itsellesi muistiin keksimäsi salasana. Tee salasanasta mahdollisimman uniikki - jos aineistossa on sama salasana useammalla, ei kukaan heistä saa tuloksia yksityisyyssuojan varmistamiseksi.

Perusta sähköpostitili, johon haluat tuloksesi. Varmista, ettei osoitteesta selviä nimesi. Lähetä salasana siltä tililtä osoitteeseen sussab@gmail.com. Saat testituloksesi kuukauden sisällä.

Kiitos!

TAUSTATIEDOT

Sukupuoli: Nainen ▼

Ikä:

Koulutus ?: Peruskoulu ▼

Koulutusala ?: yhteiskuntatieteellinen ▼

Ammatti ?

Onko sinulla lapsia?

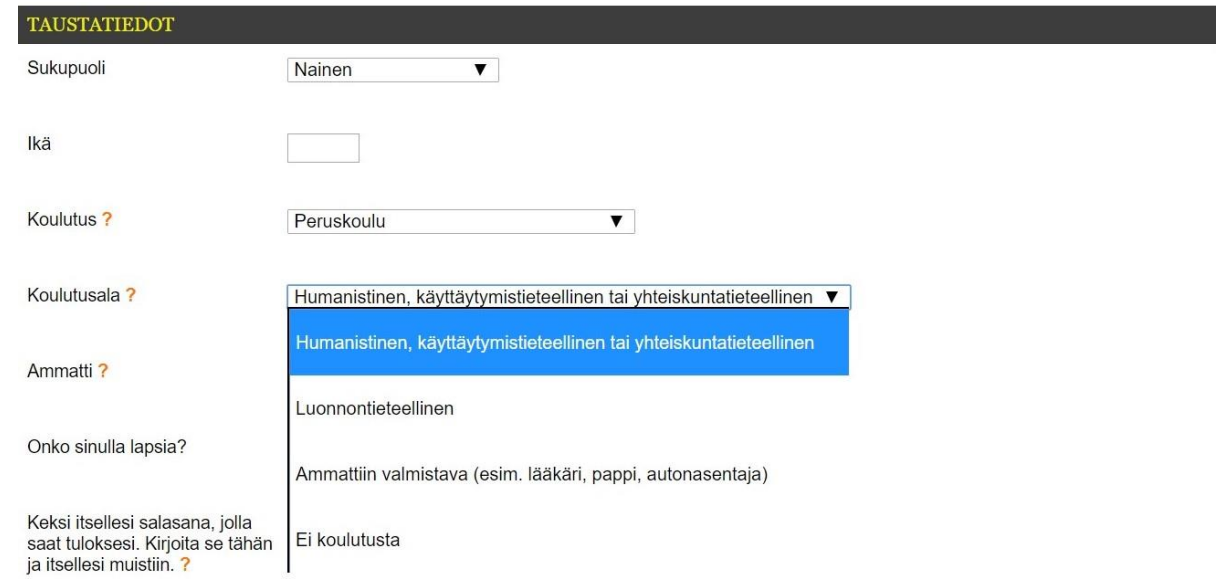
Keksi itsellesi salasana, jolla saat tuloksesi. Kirjoita se tähän ja itsellesi muistiin. ?

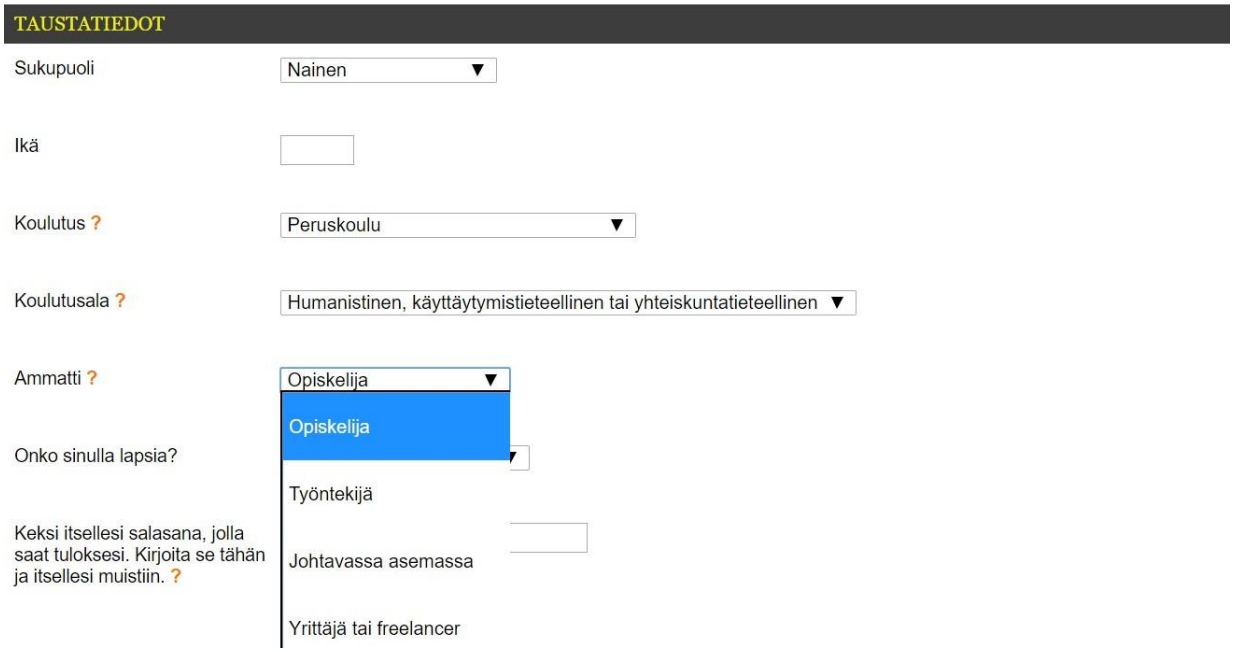
Peruskoulu

Lukio

Ammattikoulu tai ammattikorkeakoulu

Yliopisto tai korkeakoulu


TAUSTATIEDOT
Sukupuoli
Nainen
Ikä
Koulutus ?
Peruskoulu
Koulutusala ?
Humanistinen, käyttäytymistieteellinen tai yhteiskuntatieteellinen
Humanistinen, käyttäytymistieteellinen tai yhteiskuntatieteellinen
Luonnontieteellinen
Ammattiin valmistava (esim. lääkäri, pappi, autonasentaja)
Ei koulutusta
Ammatti ?
Onko sinulla lapsia?
Keksi itsellesi salasana, jolla saat tuloksesi. Kirjoita se tähän ja itsellesi muistiin. ?


TAUSTATIEDOT
Sukupuoli
Nainen
Ikä
Koulutus ?
Peruskoulu
Koulutusala ?
Humanistinen, käyttäytymistieteellinen tai yhteiskuntatieteellinen
Ammatti ?
Opiskelija
Opiskelija
Työntekijä
Johtavassa asemassa
Yrittäjä tai freelancer
Onko sinulla lapsia?
Keksi itsellesi salasana, jolla saat tuloksesi. Kirjoita se tähän ja itsellesi muistiin. ?